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VETERINARY MEDICINE

NOVEMBER 1938

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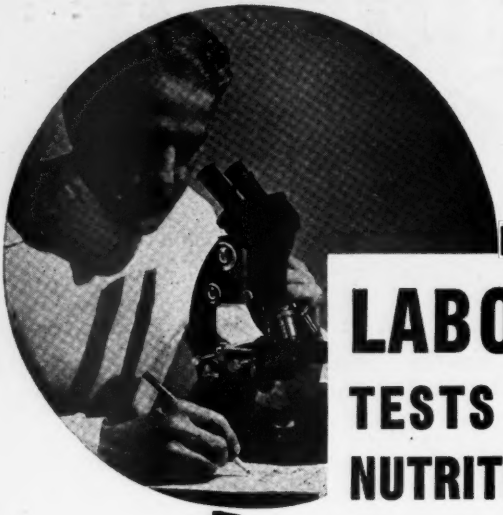

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It sounds much easier than it really is to administer an intravenous sedative to a horse plunging around in a dark barn. The mice had the same problem in belling the cat.

To build up an equine practice, learn the art of administering capsules with skill and speed. Many of our clients call us to see a sick horse because they do not want to go to the bother of drenching it.

To get the best results in colt castration, we like to have the animal kept in a small field overnight without much feed. Operated upon early in the morning, and turned out to pasture, very little swelling takes place, because of good drainage.

In the far west, castration of colts in the early autumn is becoming more and more popular. The animals seem to do better then than at other seasons, and within ten days have recovered completely.

Some men are natural-born horsemen; others are not. When we see one of the former trying to fix a tractor, or one of the latter attempting to handle a team, our sympathy goes out to them.

Man's life ought to be measured, not by the years that pass over his head, but by the colds that pass through it.—*Woods Hutchison,* M.D.

The key to successful handling of equine obstetrics is to figure out what we can do when we can't do what we are doing now.—*N. D. Backus, Elyria, Ohio.*

Mules will not reach a condition of balance where births equal deaths until 1943 or 1944, because of the shortage of good jacks to sire mules.—*Wayne Dinsmore.*

Ixodes ricinus californicus may be a carrier of tularemia to humans because it infests species of rodents known to be commonly infected in nature; naturally infected adults have been found in nature, and the adults frequently bite man. (*P. H. R.* 52:282.)

Calves fed whole milk exclusively develop nutritional anemia. The addition of copper sulphate 0.003% and iron chloride 0.02% to the ration tends to increase the number of erythrocytes and to increase more uniformly the hemoglobin content of the blood during the first 12 to 20 weeks of life.—*Mich. Bimonthly Bul.* 1937.

XIII International Veterinary Congress

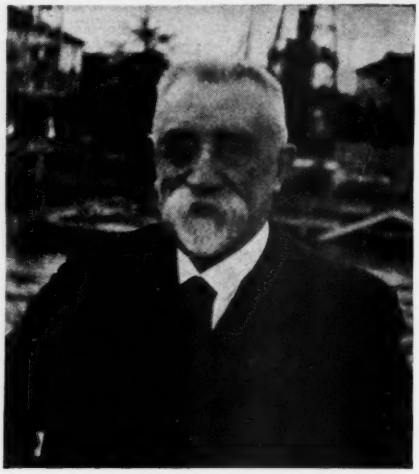
As was to be expected of an international veterinary congress held in a country having a small veterinary population, the XIII International Veterinary Congress held in Zurich-Interlaken, Switzerland, August 21-27, 1938, did not quite equal in membership or attendance the XI Congress held in London in 1930 and failed by a wide margin to attain either the attendance or membership of the New York Congress four years ago. The total veterinary (ordinary) membership of the recent Congress was just over 1400 and other memberships (extraordinary) numbered about 500. The attendance was: veterinarians, 1016; others, 423.

The Zurich Congress lacked some of the international character of the two previous congresses. Being held in a German-language country and by long odds the largest delegation to the Congress being from Germany, gave it pretty much the aspect of a German congress. Although on the program reporters from many nations were listed, many of those who would have presented their papers in other than the German language did not attend; while there were few or no absentees among the reporters from Germany and Switzerland.

As usual at International Veterinary Congresses, the subjects discussed were largely those on which world wide attention is focused, and the discussions were of the highest type, representing as they did contributions from the leading veterinarians of the world. Tuberculosis and mastitis, which in 1930 and '34 divided the keenest interest with foot-and-mouth disease, were displaced at this Congress by a discussion of diseases incident to the breeding of animals, which received more attention from reporters and interested more of those in attendance than any other group of diseases. Foot-and-mouth disease was probably second in the interest attracted.

The Zurich Congress was attended by 69 Americans and by almost as many from Great Britain. The delegations from other countries, except Switzerland and Germany, were small but numerous, comprising representation for nearly all of the 66 nations included in the organization.

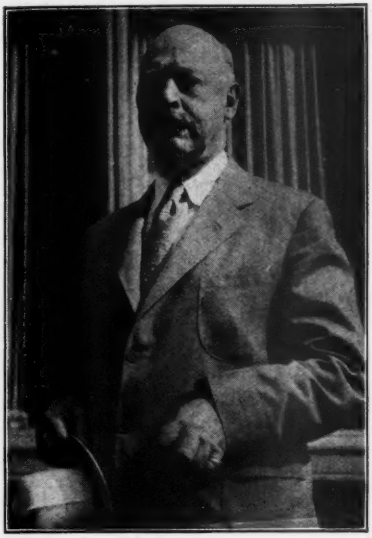
The large attendance rather overwhelmed the facilities of the Federal Technical College in which the sessions were held and



Prof. E. Leclainche, Director of the International Office of Epizootics, Paris; president of the Academy of Sciences, and Honorary Director to the Ministry of Agriculture; Hon. Assoc., R. C. V. S., and until his retirement recently, head of the veterinary service of France. At the XIII International Veterinary Congress he was awarded the Budapest Medal for the most valuable contribution to veterinary medicine during the past four years. At the meeting of the Congress in New York in 1934, this prize was awarded to Sir Arnold Theiler for his successful research into nutritional problems confronting veterinary medicine. At the London Congress, the prize was awarded to Profs. Franz Hutyra and Joseph Marek for their monumental work on the Pathology and Therapeutics of the Diseases of Domestic Animals

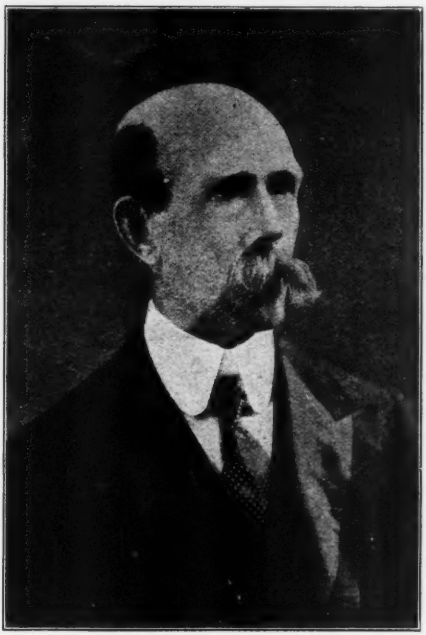
of the hotels of Zurich which were called upon to accommodate the large number of tourists normal in the city in August in addition to those attending the Congress. No assembly hall in the College could seat the greatest number in attendance at the sessions held in it. At the general banquet the inadequate facilities marred what would otherwise have been a delightful occasion.

Prof. Dr. G. Flückiger, Director des Eidg. Veterinäramtes, Berne, Switzerland,



John R. Mohler, V. M. D., D. Sc., Hon. Assoc. R. C. V. S., was born in 1875, graduated from the School of Veterinary Medicine, University of Pennsylvania 1896 and entered the Bureau of Animal Industry, U. S. Department of Agriculture in 1897; was promoted to assistant pathologist in 1899; zoologist in 1901; chief of the Pathological Division of the B. A. I. in 1902; assistant chief of the Bureau in 1914 and chief in 1917. The vast extension of work in the Bureau since that date and its notable achievements—the eradication of repeated outbreaks of food-and-mouth disease, the suppression of dourine, the eradication of bovine tuberculosis, etc.,—have been under his direction. Doctor Mohler is the author of many Department bulletins, has contributed largely to periodical veterinary literature, is a frequent speaker on the programs of veterinary, live stock and other associations. He is one of the translators of each of three English editions and one of the editors of the fourth edition of Hutyra and Marek's Special Pathology and Therapeutics of the Diseases of Domestic Animals; one of the translators of Edelman's Meat Hygiene and of Ernst's Milk Hygiene. In 1912-13, he was president of the American Veterinary Medical Association; in 1930 he was made an honorary associate member of the Royal College of Veterinary Surgeons, and in 1934 was president of the XII International Veterinary Congress. In 1935 he was elected vice president of the Permanent Committee of the International Veterinary Congresses.

was chosen president of the Congress. It was voted to hold the next meeting in Berlin. The Budapest prize, which is awarded at each Congress to the veterinarian who, in the opinion of the Permanent Committee, has made the most valuable contribution to veterinary medicine since the preceding Congress, was awarded to Dr. E. Leclainche, Paris, in recognition of his History of Veterinary Medicine. Two outstanding veterinarians of the world were elected to honorary membership: Dr. John R. Mohler, in recognition of his achievement in practically eradicating bovine tuberculosis from the United States; and Sir John McFadyean, in recognition of more than 60 years of fruitful labor in veterinary research, education, organization and literature.



Sir John McFadyean, M. B., B. Sc., M. R. C. V. S., LL. D., F. R. S. E., was born in 1852, graduated by the Royal (Dick) Veterinary College in 1876. For 16 years he remained at his alma mater, teaching anatomy. Going to the Royal Veterinary College (London) as principal in 1892, he guided the destinies of that institution till his retirement in 1927, after 51 conspicuously successful years in veterinary education. In 1888, McFadyean established *The Journal of Comparative Pathology and Therapeutics*, which he still edits after more than 50 years. Up until the year of his retirement, he was constantly engaged in veterinary research and his contributions to scientific veterinary medicine and to veterinary literature have been enormous. Many years he served on the council of the Royal College of Veterinary Surgeons and four terms as its president. He was president of the 10th and 11th International Veterinary Congresses and at the recent meeting of the International Veterinary Congress was elected to honorary life membership

Flight Speed of Birds

May Thatcher Cooke of the Biological Survey has compiled a brief summary of some of the more reliable reports on flight speeds of birds. Drawing on information in nearly 100 books and articles, she has tabulated records for more than 100 birds. Duck hawks, attaining a velocity (in dives) of 165-180 miles an hour, are the fastest flying birds reported. Other recorded speeds include:

Mallard duck	50-60 miles per hour
Pintail duck	65 miles per hour
Canvasback duck	72 miles per hour
Purple martin	20 miles per hour
Blue jay	20 miles per hour
Ruby-throated hummingbird	45-55 miles per hour
Bob white quail	28-49 miles per hour

A chemist points out that the human nose contains the most perfect air conditioner known—in a space of less than a cubic inch.—*S. N. L.*, 33:6.

Statistically, the yearly incidence of trichinosis has considerably increased in recent years. Although no new diagnostic method was used during the time concerned, the stimulated interest in the disease may have played a part in the increase in reported cases.

There is a definite seasonal fluctuation in the occurrence of trichinosis, with the peak in winter and a decline in summer. The geographic distribution of trichinosis cases shows the highest incidence in the eastern and western parts of the United States.

A study of the milk and fat production of dams and their daughters, the progeny of seven bulls at the Florida Experiment Station herd, showed differences in the ability of the sires to transmit high milk production, but none produced daughters whose records were all above that of their dams. There was a tendency for the daughters of the highest producing dams to produce smaller amounts of milk and fat than their dams.

In 1936 rabies was diagnosed in 905 dogs, 34 cats, 14 horses, 144 cattle, 50 sheep, 11 goats and 71 hogs in Yugoslavia. During the same period, it was diagnosed in 224 dogs and 38 other animals in Czechoslovakia.

Experiments conducted by Dr. W. DeB. MacNider of the University of North Carolina's Medical School indicate that resistance to infection increases with age.

An analysis of 82 daughter-dam comparisons of milk and butterfat records at the Florida Experiment Station herd showed a small but positive tendency for daughters from higher producing dams to yield more milk than the average of those from medium and low producing dams.

Pasteurization renders milk infected with Bang's disease non-infective to susceptible experimental animals, but to assure additional protection to public health, there is a growing demand that herds be free from Bang's disease that fear of possible illness from consuming milk in large quantities may be eliminated.

To attach labels to tin, mix one part tannic acid to three parts chloroform and shake well. Apply this to the tin surface, and allow to dry. Then attach the label.

Capt. Rudolfo Andreoni of the Italian Chemical Military Service, experimented with auto- and heterologous proteins in the treatment of skin lesions, the result of mustard gas burns in dogs. Subcutaneous injections of the animal's own blood and of sterile milk and normal horse serum, were used. Neither treatment, the auto-blood or the foreign protein, exerted any effect on the course or termination of the burns. The percentage of mortalities was the same under both systems of treatment and identical with that in untreated dogs. The decrease in weight of those treated was of the same degree as of those not treated and evolution of the local cutaneous injuries was neither lessened nor accelerated, nor was their intensity modified by the treatment.

Paragraphs from the 13th Annual Report Los Angeles County Live Stock Department

In view of the occurrence of coryza-like and laryngotracheitis-like disease, the importance of a correct diagnosis in connection with the vaccination of flocks for laryngotracheitis is obvious. . . . The application of laryngotracheitis vaccine in a flock suffering from coryza or other respiratory diseases may apparently intensify the death rate. . . . Since symptoms of dypsnea, or gasping, may be present in different diseases of poultry, an unproved diagnosis of laryngotracheitis followed by vaccination may not only fail to check the disease, but also may superimpose laryngotracheitis upon an existing infection.

Many or all of the benefits of pasteurization of milk as a public health measure may be nullified by improper handling of milk after it is pasteurized. Many glass bottles were found to contain a large number of bacteria in a survey of 25 milk plants in Illinois. The two main causes for these high counts were that the alkali solution in the bottle washers was not always strong enough to kill the bacteria and that many times the bottles were left in warm, damp rooms too long after washing.

Until such time as the stray dog menace is completely eliminated, it is believed that the best protection that can be afforded domestic live stock is to fence corrals carefully with woven wire. This fence need not be over waist-high as rabid dogs do not ordinarily leap obstacles but rather go around them in their aberrant meanderings. . . . Just so long as stray dogs are permitted to roam, ravage, and reproduce at will, just that long will rabies, one of the most dangerous diseases, lurk in waiting a fortuitous circumstance when it may endanger or claim another victim, human or animal.

Necrotic enteritis is each year becoming a more serious scourge of swine. Epecially severe and expensive outbreaks of the disease are encountered most frequently in grain fed hogs; the heaviest losses being among those weighing 200 to 300 pounds, and about ready for market.

Until the specific agent involved in the so-called cornstalk disease in horses can be defined, control measures recommended in the prevention of this disease include prompt elimination and stimulative treatment of afflicted animals. These measures in the early stages of the disease have yielded quite satisfactory results. Prevention by keeping horses out of cornfields is of the greatest importance.

As the result of an increasing number of cases of undulant fever in man and its close relation to Bang's disease it is apparent that the successful elimination of the disease in cattle may be the means of reducing or eliminating undulant fever in man. . . . Most failures in the establishment of herds free from Bang's disease are traceable to failures in the execution of proved methods of preventing Bang's disease rather than to defects in the essential measures designed to check the disease.

* * * *

A fee that leaves a friendly feeling in the mind of the client is a business builder. For that reason, we like to make the owner of a horse that failed to reach a ripe and happy old age following our treatment, a lower charge for our services than if it had recovered.

This animal was treated for septicemia until a bacteriological examination revealed the presence of malignant edema organisms.

Heart Worm Infestation of Dogs

By MADERO N. BADER,
Galveston, Texas

IN WRITING this paper I have endeavored to get away from a technical discussion and to give the picture as I see it in everyday practice. My opinions may not agree with those of other practitioners.

On the average, I see six new curable and two or more incurable cases of heart worm infestation every week. Each of these animals presents a distinct case history. I do not mean that each case has different symptoms; however, they do have a mixture of symptoms or a varying number of symptoms that overlap. The symptoms that I encounter in the order in which they are commonly presented, are:

1. Lack of animation in house and yard dogs, and lack of stamina in working dogs.

We treat many hunting dogs and the usual history is that they are not able to complete a hunt. The hound dog will fall out of the pack, usually after a run of an hour or two. The affected bird dog usually returns to the hunter and stays at his heels after a short run.

The house or yard dog usually exhibits just a general lack of animation. The owner will notice that he does not have his usual pep and in many cases, the appetite is impaired.

2. Coughing, sneezing and sniffling.

This is a constant symptom where the animal is heavily infested. The cough is what the owner is worried about, since the dog appears to be normal in every other way. However, there may be an overlapping of symptoms, viz., coughing and lack of animation. Sneezing and sniffling is observed more often in house and yard dogs than in working dogs.

3. Eczema. This symptom ranks with lack of animation, as a large percentage of the animals show a dry, scaly eczema. I find this condition more frequently in older dogs, that is, dogs over three or four years of age.

4. Vomiting. This is also a constant symptom of heart worm infestation. When the blood is checked, a great number of cases diagnosed as gastroenteritis turn out to be filarial infestation.

5. Ascites. This symptom is listed toward the last, since by the time an animal has developed ascites, it is usually beyond successful treatment.

6. Heavy breathing. The animal seems to breathe heavily and blow his breath out through the sides of his lips.

7. Generalized pain. We find a few animals that cry when touched and seem to be in pain whenever they move. I have had only ten or fifteen dogs that presented this symptom. All pain appears to leave following successful treatment.

8. Enlarged lymph glands. This is not a common symptom.

9. Hemorrhage from nose, rectum and petechiæ on mucous membrane of the mouth.

These, briefly, are the symptoms that are most commonly found at my clinic.

Diagnosis

The most common method of diagnosis is direct blood smear. In this smear, we find the live microfilariæ wriggling in the blood; a picture akin to mosquito larvæ wriggling in a can of water.

For the past three or four months, we have been using a centrifuge in making the blood examination. Five cubic centimeters of a 2% solution of glacial acetic acid is added to 1cc of blood. This is placed in the centrifuge and allowed to whirl from three to five minutes. The blood is then decanted. A drop of the sediment (well mixed) is examined. If filariæ are present, they appear to be about three-quarters of an inch long (under low power) and are rounded on one end and pointed on the other. The field with a heavy infestation looks like a bunch of fine straw particles scattered around. By proper focusing, each individual filaria can be brought out.

The direct smear method is only about 50% effective in making a diagnosis. A negative smear does not mean that the dog is free of filariæ. At least four negative smears are necessary to make a diagnosis of no filariæ. In the examination with the aid of a centrifuge, a whole cc of blood can be examined, whereas with the direct smear, only a few drops can be examined at a time.

In practice, the direct smear has a definite advantage over the centrifuge smear in that the owner of the animal can see the microfilariæ wriggle and comprehend his animal's condition a great deal more readily. I make it a practice to show all of my clients the microfilariæ under the microscope. This, combined with a specimen of a heart completely filled with worms, gives the owner a pretty good idea of the condition of his animal.

I extract the blood from the radial vein, using a 24-gauge needle. The area is clipped and disinfected with alcohol. The assistant holds the dog's mouth with his right hand and with his left, holds the dog's right leg firmly just below the elbow joint. This causes the vein to stand out prominently and there is little or no difficulty. The blood is then added to the acid and run in the centrifuge.

Treatment

The average dog in good condition, given the proper dose of fuadin, responds to treatment very nicely. However, there are a great number of pitfalls in treating dogs affected with heart worm.

There seems to be a lack of calcium associated with filarial infestation. This can be overcome readily by injections of calcium gluconate. This lack of calcium manifests itself by the so-called reaction to fuadin; that is stiffness, lack of appetite and lack of animation. The dog will lie around as if in a stupor. Calcium gluconate will bring 95% of them out.

There is another type of reaction, namely, vomiting. When this occurs, treatment must be stopped at once. If it is not, two or three extra injections usually put the patient in dog heaven.

Whenever there is a reaction, treatment should be suspended for a few days. The dosage of fuadin as outlined by the manufacturers should be used only as an indicator. One has to find his own dosage for individual patients. Most of our trouble in determining the proper dosage has been with larger dogs, those weighing 60 pounds or over. The dosage recommended by the manufacturer seems to be a bit too heavy for large dogs, especially at the start.

All of the fuadin injections at my clinic are given intramuscularly. I have had no success treating animals by intravenous injection. The intravenous method has only one advantage over the intramuscular method and that is a saving in time. Only eight injections are required intravenously, as compared with 18 injections intramuscularly.

Summary

1. The symptoms are so varied that no single symptom or set of symptoms can include all of them presented by this condition.

2. Proper treatment at an early stage is very effective in clearing up heart worm infestation.

3. The use of calcium gluconate injections, along with treatment, as indicated.

4. Dosage should be worked out for each individual dog.

5. Dog owners should have their dog's blood checked three times a year.

6. One negative blood examination does not mean that the animal is free of filariæ.

7. Better results are obtained by the intramuscular than by the intravenous route in administering fuadin.

* * * *

There are five veterinary colleges in India, located as follows: Lahore, established 1882; Bombay, established 1886; Calcutta, established 1891; Madras, established 1904, and Patna, established 1930.

* * * *

It costs the modern farmer no more time and labor to produce 5,000 bushels of corn than it took a farmer 100 years ago to produce 250 bushels.—*S. N. L.* 34:5.

Sulfanilamide in Veterinary Therapeutics

GUSTAVE LABELLE, LaTrappe, Quebec,
École de Médecine Vétérinaire,
Université de Montréal.

OF recent months, veterinary medicine has been enriched by a new drug — para-amino-benzene-sulfonamide—or, to use the name given it by the American Medical Association, sulfanilamide. For two years it has largely occupied the minds of practitioners of human medicine and much research has been undertaken, nearly all of it by workers in that field.

In collaboration with the Animal Health Service of the Department of Agriculture of Quebec, the author undertook a series of research problems upon the physiological properties and therapeutic indications and posology of sulfanilamide, in the field of veterinary medicine. As a result of this work, the conclusion that this marvelous therapeutic agent deserves the title of "streptococcus conqueror" is inescapable.

EVER since the beginning of the Pasteurian era, research has sought an agent, either chemical or biological, having the property of destroying microbes and, in particular, streptococci. Heretofore little success has attended this stupendous effort. Judging, however, from recent results obtained by the use of sulfanilamide, we believe this compound is destined to play a role of first importance in the treatment of bacteriological diseases of animals by equipping the practicing veterinarian with a powerful streptocide.

As all know, Heidelberger and Jacobs of the Rockefeller Institute, described the properties of sulfanilamide in 1919, and 16 years later, Domagk, a German chemist, studied the physiological properties in small animals. His experiments proved that this chemical, administered orally, is a streptocide of the first order and an excellent therapeutic agent. By what mechanism and in what way it acts is far from being established, but Long and Bliss conclude it has properties that favor phagocytosis.

ALWAYS in full collaboration with the veterinary service in Quebec, we have experimented with it in the treatment of many diseases of domestic animals, but our main work was in the treatment of polyarthritis of young foals, a disease alarmingly frequent in the Province of Quebec, where 15 to 20% of the young animals are lost. After experimenting upon some 200 subjects, we must say the results obtained were superior even to our expectations.

At the beginning of our work, the posology of this medicament was hardly established. We had the indications furnished by Merillat in his fine article in VETERINARY MEDICINE (Feb. 1938, p. 53), but the doses our eminent colleague recommended were insufficient for large animals.

WITH a view to establishing a rational posology, we have experimented on a large number of animals, by augmenting the dose progressively and, at the same time, watching attentively the state of their blood by globular numerations before, during and after the treatment, to see if certain reactions symptomatic of intolerance were manifested. In large animals even with doses as large as 40 grams a day, given in divided doses, we have not observed any accident due to overdosage. With the doses previously cited, the globular numeration of the blood has at no time indicated an acute anemia.

In foals suffering from polyarthritis, septicemia of the new-born or omphalophlebitis, sulfanilamide was administered in the manner indicated below:

1st day, a dose of 1 gram 5 times daily, at 3-hour intervals
2nd day, a dose of 1 gram 4 times daily, at 3-hour intervals
3rd day, a dose of 1 gram 3 times daily, at 4-hour intervals
4th day, a dose of 1 gram 2 times daily, at 6-hour intervals
5th day, a dose of 1 gram at noon.

Considering that this agent is most active in an alkaline medium and to prevent

acidosis, it is prudent to administer it with an equal quantity of sodium bicarbonate given orally in a little mare's milk.

IN 95% of our cases of polyarthritis, septicemia of the new-born and omphalophelebitis, with or without complications, complete cures were obtained promptly. In two foals affected with septicemia with pneumonia as a complication, recovery occurred only after 12 and 15 days respectively.

Following the administration of sulfanilamide the appetite returns, the general condition is better, the temperature gradually decreases and in polyarthritis, the inflammation at the different articulations, hock, fetlock joint, disappear progressively. In most cases, we have been surprised at the rapidity of the cures. In some cases constipation may supervene, but it responds promptly to castor oil.

To test further the tolerance of the animals for this medicament, we instituted a second course of treatment after the foals had recovered. At the end of the second treatment, the count of globules in the blood did not indicate anemia.

Sulfanilamide was also experimented with for the treatment of certain bacterial diseases that affect large animals, such as glanders, influenza, mastitis, traumatic arthritis, septicemia following surgical intervention, metritis, pneumonia, white scours of calves, etc. On the whole the results were very encouraging.

CONCERNING the posology of sulfanilamide for large animals, we may conclude that this medicament may be safely administered as follows:

1st day, a powder of 8 grams 5 times a day at 3-hour intervals
2nd day, a powder of 8 grams 4 times a day at 3-hour intervals
3rd day, a powder of 8 grams 3 times a day at 4-hour intervals
4th day, a powder of 8 grams 2 times a day at 6-hour intervals
5th day, a powder of 8 grams 1 time a day at noon.

In cases less serious, begin the treatment with four powders a day and continue as indicated, the whole treatment requiring ten doses instead of 15. To prevent acidosis, administer the powders with an equal quantity of sodium bicarbonate.

AS sulfanilamide is without odor or bad taste, it is practical to administer it to large animals mixed with the feed. If it is refused or the animal is not eating, it may be administered as an electuary. To avoid incompatibility in all cases, administer no other medicament at the same time, especially no saline purgatives.

In conclusion, we do not want anyone to understand us to mean that this benzene derivative is a panacea, but we believe that it is a therapeutic agent of first order, easy of administration, relatively economical, that may render appreciable service in all classes of acute streptococcus infections in animals.

* * * *

In an experiment carried out by Rebrassier of Ohio, to determine the effectiveness of various anthelmintics in the treatment of stomach worm infestation in sheep, tetrachlorethylene made the best showing; a mixture of copper sulphate and nicotine was second best, and copper sulphate alone stood third. Other anthelmintics tried were much less effective than any of the foregoing.

* * * *

In an experiment carried out by Rebrassier of Ohio, lambs that had been infested with stomach worms made no gain in weight on pasture alone, from June 15th to October 1st. Similar lambs treated every three weeks with effective anthelmintics (tetrachlorethylene or copper sulphate and nicotine) made an average gain of over four pounds during the same period. Similarly infested lambs receiving a small quantity of grain in addition to pasture, made an average gain of 21 pounds without treatment and 25 pounds with treatment. In this experiment, a pound of grain daily per lamb was five times as effective in producing gain as was anthelmintic treatment every three weeks.

Equine Conditions in Puerto Rico

By WILBUR McPHERSON,
San Juan, Puerto Rico

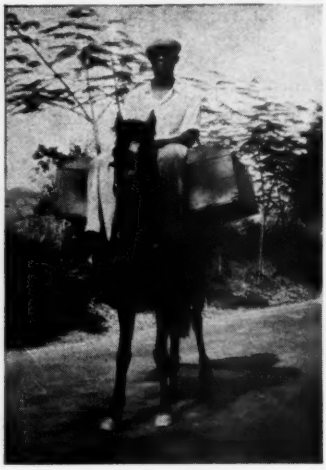
Puerto Rico lies between the Atlantic ocean and the Caribbean sea, 1400 miles southeast of New York city, 1000 miles southeast of Miami. The island is approximately 110 miles long and 35 miles wide. It has an area of about 3,850 square miles, or 2,500,000 acres. A central mountain range extends from east to west, and except for a comparatively level coastal plain of varying width surrounding the island the terrain is quite rough, and the scenery very beautiful.

While the climate is tropical, it is quite pleasant because of an almost constant trade wind from the northeast. The thermometer never goes high. There is but a slight variation in temperature during the entire year, the lowest ever recorded being 62° F. and the highest 94° F. The average is around 78° The 2,000,000 inhabitants make a population density of 520 to the square mile, or over ten times the number per square mile in the United States. The density of the population, and the comparatively high cost of land are factors which are not conducive to livestock production as a means of livelihood.

There are approximately 50,000 horses and about 8,000 mules and asses on the island. The horses, generally, are small in size, and have a good gait for riding. Running races are held in San Juan at two tracks twice weekly and on holidays the year around.

The number of mules is small since there is not much reason for producing or importing them. Oxen being used almost exclusively for hauling the sugar cane there is less demand for other draft animals.

The plan followed in feeding the animals is entirely different from that practiced in the States. The forage is cut green and fed immediately, rather than cured for use in the form of hay. Several grasses found here grow luxuriantly during the entire year, namely, malojillo, guatemala, elephant, guinea grass and molasses. Malojillo is the same as Para grass, which is common in south Florida. It is cut six to ten times a year, depending on the soil and moisture, and yields 30 to 40 tons per acre during the 12 months.



Crab Pie Vendor
The native horse is capable of carrying extremely heavy loads considering its size.

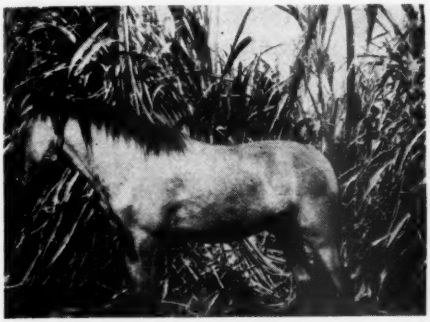
Owners of livestock in Puerto Rico probably know less about treating and nursing animals affected with non-parasitic diseases than in the States, but they have more knowledge of the treatment of parasitisms.

Sarcoptic mange is found only rarely in horses, but the psoroptic variety is common in the dry southern coastal plain and in wet regions, although not in the mountains. It is reported that ringworm exists on horses, and that through the saddles and clothes, the riders become infected. However, this as the cause of ringworm in man has not been confirmed.

The veterinarian sees more chokes in Puerto Rico in one year than he would see in the States in a lifetime.

Of the acute infectious diseases anthrax is probably the most prevalent, and has quite a high degree of virulence. It is,

however, confined to well-defined districts. A vaccine containing a higher antigenic value than is available at present is required.



Native saddle horse. For riding purposes uncastrated horses are preferred to geldings or mares.

Tetanus is ever present, as would be expected in this tropical area. It also has a high degree of virulence, requiring that tetanus antitoxin be administered for the slightest lesions.

Ticks are found in very heavy infestations. A disease which has not been classified exists among horses; it is probably due to a fungus. The lips and jaws are affected, and as the condition progresses, the tissues of this part of the body are eaten away, causing the teeth to be exposed.

Epizoötics of colics in the horse exist to the greatest extent on the southern coast. The animals first show a slight colicky pain, with increasing intensity. They frequently develop a rupture of the stomach or obstipation of the large intestines. Colic in this form makes its appearance following rains, especially the light rain falling during the night. About 20% of the horses on pasture can be expected to develop symptoms of this ailment, and the mortality among those affected runs up to 12%. The cause of these colics is not known; a thrombo-embolic condition, however, has been observed.

There are few plants poisonous to animals in Puerto Rico; they are much less common than in the southern United States. In a part of the dry southern coastal section a plant called Zarzarilla is found. The natives claim that this rather bushy plant when eaten by horses causes the hair of the mane and tail to fall out. Very little investigational work has been done with plants having poisonous properties, and information along this line is, therefore, limited.

A few horses and mules at Salinas, P. R. (Owned by Central Aquine)

Contagious Ward for Animals Erected by the 20th Engineers A. E. F.

Breakfast Cart in the Virgin Islands

Equine Practice in Malaya

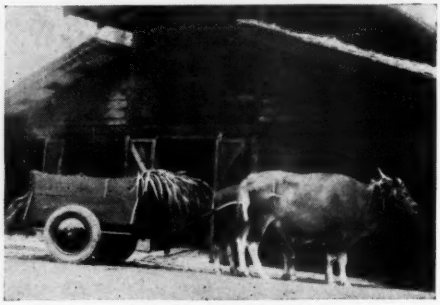
By A. R. ROBERTSON,
Singapore, Straits Settlement

TO WRITE something on equine practice in Malaya is almost analogous to telling of the water buffalo practice in America. There just isn't much. In the whole of Malaya, which is an area the size of Alabama, there are fewer than 1000 horses.

Of a total land area of 52,000 square miles in Malaya there are approximately 42,000 square miles covered with tropical jungle. The western coastal region lying at sea level and known as the plains of Malaya show some development but the rest of the country one might say is undeveloped. The city of Singapore is on Singapore Island situated at the extreme southern tip of Malaya and Asia, being cut off from the mainland by the Straits of Johore. The city has a population of one-half million and is really the only city in Malaya. There are no seasons here unless it would be the warm season and the still warmer season. The humidity runs around 90% and the climate naturally is depressing. In such a climate one would not expect to find many horses and indeed those that do race here can run only a few years.

Rubber, the major agricultural crop, occupies one-half the land available for cultivation or some 5200 square miles. On all the rubber plantations not a horse is used other than a saddle horse perhaps for the "tuan besar" (the big master). What is true of rubber estates is likewise true on smaller holdings of coconuts, rice, oil palms, pineapples, sago, tapioca, fruits, vegetables, bananas, and sundry other agricultural crops, except that there is usually not even the saddle horse. The tractor is not a competitor of the horse in Malaya but bullocks and coolies are, and the latter seem to have a slight advantage.

On our dairy farm where we raise considerable grass, (40 tons per acre annually) for cattle feeding the work is all done with coolies and bullocks. Coolies do the cultivating, weeding, and cutting of grass and other work which in America would be performed by horse drawn machinery. The hauling is done by fourteen bullocks from the island of Bali and every one looks as though it had sat down in an egg shaped tub of white paint and got itself a white rump. This is a characteristic marking of



Malayan Transport.

Bali cattle (note illustration). The speed of these bullocks seems to be about right for the native; slow and slower. And so it goes for the whole of Malaya.

A rather complete livestock census was taken recently in Malacca, one of the small cities of Malaya, and to me it disclosed some interesting information—10,416 buffaloes used for agricultural purposes, 25 buffaloes used in trucking, 2,125 general purpose buffaloes, and 51 saddle horses. I had thought that there are more used for trucking but perhaps that is because I have been annoyed so many times by having to throttle down my 8 h.p. Ford to amble along through a busy stream of traffic behind some calm coolie in his bullock cart idly clucking to his loitering steeds.

Here's an article supposed to be written about the equine species and I am telling more about the bovine so I had better get back on my horse. The few horses in Malaya could be classified as racehorses imported from Australia and the British Isles; polo ponies which are mostly ex-racehorses; hacks, almost exclusively ex-racing animals; and a few gharry (carriage) ponies shipped in from the Netherlands Indies. The total

number of horses in Malaya is probably close to 1,000 animals.

Horse rations in this country are not too well balanced in respect to mineral constituents with the result that deficiency diseases are fairly common. Some racehorse men use mineral supplements but such a practice is exceptional. Osteoporosis is one of the most common ailments of horses in Malaya. The veterinary authorities have presented feeding formulas which they recommend in Malaya as follows:

Horses doing moderate work—

Oats	7 lbs.
Oaten chaff	3 lbs.
Meadow hay	10 lbs.

Horses doing fairly fast work—

Oats	10 lbs.
Bengal gram	1 lb.
Oaten chaff	1½ lbs.
Alfalfa chaff	1½ lbs.
Meadow hay	8 lbs.

Horses doing fast work—

Oats	12 lbs.
Bengal gram	2 lbs.
Alfalfa chaff	3 lbs.
Meadow hay	6 lbs.

All of the above feeds are imported from Australia with the exception of Bengal gram which is a protein feed shipped in from India.

Another ailment of horses in Malaya is "dry coat" or anhidrosis. In recent years this condition has received some research by the government officials and racing people. Work in India with dry coat of race horses suggested a form of sub-acute heat stroke and a disease of dietetic origin. There seemed to be a C-avitaminosis with a lack of sodium chloride, and hypofunction of the adrenal cortex. It was found that when vitamin C in the form of germinated gram (bean), sodium chloride and whole adrenal gland powder were fed in the ration that dry coat, in cases not too severe, showed a marked improvement in the general condition of the animal. The coat took on a luster and perspiration increased after exercise. In serious or totally dry coated animals the above method of treatment was disappointing.

Climatic factors of heat and humidity are also thought to be contributing agents causing dry coat. With this in mind horses have been sent for a rest to the Highlands of Malaya at an elevation of 3,600 feet where the temperature is almost comparable to the summer temperature of the temperate zone. Horses kept in the Highlands for a few months have been cured of dry coat. These animals invariably return to the lowlands improved physically and seem to have a habit of winning races. More and more the racing people are appreciating the beneficial effects derived from this change in climate with the result that each year sees more horses going to the Highlands. Even under the best of conditions in the tropics of Malaya, however, horses cannot stand up, nor can they perform as they do in a temperate climate.

Parasitism does not seem to be a factor here probably because all horses are stall fed and not run on pastures.

Strangles was noted in horses shipped into Singapore and Penang from overseas during 1936. Prompt isolation of infected animals and other necessary precautions prevented a spread of the disease.

The handling of horses in Malaya is done almost exclusively by Malays and Javanese. They are not noted horsemen, as a matter of fact there seems to be but one thing for which they are noted and that is laziness. However I am not wholly convinced that that is true. It may be that they know best how to live in this climate. At any rate they are courteous and pleasant.

Although these horse attendants or "syces" as they are called do not have a labor organization it is impossible to get a syce to care for more than one horse. As the saying goes "one horse one syce". These syces exercise their horses early in the morning, followed by cleaning up the stall and rubbing down the horse, and the rest of the day apparently is spent in sleep. When the tuan besar shows up in the late afternoon for his daily canter everything is ready for inspection, or nearly so.

* * * *

Clients appreciate electuaries whenever it is possible for them to administer this kind of medication to horses, mules or colts.

Bacteriologic Diagnosis of Infectious Encephalomyelitis*

Various investigators state that the symptoms of infectious encephalomyelitis, or "derringue," as we call it here in Mexico, vary according to the different breeds. No one, however, has made a laboratory confirmation of the clinical diagnosis. My findings along this line are presented in this article.

In November, 1936, Dr. Manuel Chavarria was called to State of Oxaca to make a clinical study of an epizoötic among horses. In the town of Pinotepa de Don Luis he found 15 horses that showed clinical symptoms of infectious encephalomyelitis. From this group he obtained nerve tissue from the brain, cerebellum and medulla, under the most aseptic conditions. These specimens, preserved in a glycerine phosphate solution, were given to various investigators in our laboratory.

Approximately one gram of this tissue was ground in a mortar with sea sand, emulsified with 10cc of physiological normal saline solution, and immediately filtered through cotton. The emulsion thus obtained was inoculated intradermally into two lots of laboratory animals, one of four guinea pigs, and the other of four rabbits. The guinea pigs were given 0.2cc daily and the rabbits 0.4cc. These animals were observed daily. On the 17th day the guinea pigs began to show symptoms of paralysis, with periods of excitement and slobbering, and died on the 18th day after the inoculation.

The nerve material of these guinea pigs was made up according to the same technique as that taken from the horses, and used in the same manner to inoculate four more guinea pigs. In this second passage death resulted on the 16th day, the animals showing the same clinical symptoms as the first lot. Material from this second group was inoculated into a third group of guinea pigs, using the same technique. These animals died on the 13th day after the inoculation. A fourth group was inoculated under the same circumstances, and the animals died on the 8th day. Thereafter 15 more inoculations were made, with the same result as that of the fourth inoculation, proving that after the fourth series one obtains a fixed virus.

The four rabbits that were inoculated in the first group became sick 20 days after inoculation, dying on the 23rd and 24th days, but no further inoculations of rabbits were made, as it appeared that guinea pigs are a better test animal for this condition.

Ten young pigeons were inoculated with this material to determine the differentiation between equine encephalitis and infectious encephalomyelitis; as they did not develop symptoms of ataxia or paralysis, it was concluded that the condition was infectious encephalomyelitis, as described by Drs. L. T. Giltner and M. S. Shahan.

FERNANDO CAMARGO,
Mexico City, F.D., Mex.

*Read before the meeting of the Houston Veterinary Association at Houston, Texas, March 3, 1938.

Bovine Allergic Dermatitis

This disease (also known as photosensitization, light sensitization, wheat poisoning, blistering disease, itching disease, or fagopyrism) occurs principally in the bovine species, young and old being affected. Cows over two years of age seem to be most susceptible.

The cause of this disease is not known, but the general opinion is that it may be due to some substance in the pasture material in conjunction with the rays of the sun. The mortality rate is low, the most serious results ordinarily being a decreased milk flow and loss of flesh.

A typical clinical picture of this disease was seen in the following case:

A herd of thirty Hereford yearlings, most of them heifers, was turned out on bluegrass in central Iowa about the middle of May, 1937. They progressed nicely until the middle of June, when we were called to observe a heifer which the owner thought had been struck by lightning.

The animal showed slight restlessness, but temperature, pulse, and respiration were normal. The skin was dry and parched. There was a definite arch in the back.

Three days later there was a slight sloughing of the mucous membrane lining the anterior portion of the nostrils, and also

at the commissure of the lips. The white areas on the animal, especially of the head, were very dry, and the skin was cracked and curled up in pieces about the size of a half-dollar. The skin covering the teats was practically all sloughed away. The animal was more restless and irritable, and the eyes were swollen nearly shut.

The condition of the animal rapidly became worse, until at the end of 14 days the skin was hanging from the head, neck, back, and flanks in pieces ranging from 3 to 15 inches in length, and 2 to 4 inches in width. The swelling around the eyes had disappeared, but the skin had sloughed and curled downward until the vision of the animal was entirely obstructed. These pieces of sloughing skin could be easily removed, leaving a raw, bloody surface.

At this stage the sloughing was not limited to the white parts of the animal, but had spread to the pigmented portions also. The skin covering one ear was readily pulled off. An area about 4 inches wide from the withers posteriorly along the back and down over the buttocks was entirely devoid of skin. Smaller areas along the sides of the animal, and on the sides of the neck, had also sloughed off. The heifer appeared to have reached the peak of the disease, and was devoid of approximately one-sixth of its skin.

Treatment

1. The animal was removed from the bluegrass pasture, and placed in a clean, dark building.

2. The diet was changed from bluegrass to yellow corn, oats and timothy hay.

3. Four intravenous injections of 200cc of a 20% calcium gluconate solution and 500cc of a 50% glucose solution were given at three-day intervals.

4. The denuded areas were sprayed by the owner three or four times a day with a 1% pyoktanin blue solution, followed by a spray of campho-phenique.

The heifer showed such marked improvement by the time of the fifth visit that the intravenous therapy was discontinued. At the end of 18 days the skin was growing in nicely over the denuded areas.

As the rest of the animals on the bluegrass pasture showed no symptoms of the disease, it is concluded that individual susceptibility to the disease is a factor in its onset, in conjunction with the pasture material and the rays of the sun.

D. L. CASSIDY,

Manhattan, Kans.

Mortality Among Laying Hens

The most critical question facing the poultry industry today is that of the huge losses of adult birds from disease and internal parasites. According to a recent authoritative estimate, during 1936 these losses amounted to $6,483,774 in Ohio alone. In 10 leading poultry states they totaled $43,500,000. Since no state has a monopoly on this side of the poultry business, what would the loss be for the country as a whole? These losses represent dead birds only. In addition, there are the losses from an equal or greater number of cull birds. Culls are inferior or unfit birds, many of which are removed in anticipation of death; a small proportion of such birds is salvaged as market poultry.

A survey of poultry farm demonstration records, secured under state supervision, from a number of leading poultry states reveals that the average first-year flock reduction of pullet layers is from 40 to 60%; that 15 to 25% is due to mortality; and that the remainder is due to culls.

The history and experiences of the Ohio Station's poultry plant during the past 15 years may be cited as a specific instance of what has been taking place in varying degrees throughout the country at large. The average first-year mortality (no culls removed) of pullet layers from 1921 to 1924 was 13.2%; from 1925 to 1928, 38.4%; and from 1929 to 1937, 50 to 60%. Although there was a marked rise in mortality from 1925 to 1928, it was after 1928 that the losses mounted to a half or more of the Station's flocks. Coincidentally, it was in 1928 that fowl paralysis and allied complications made their first appearance at the Station; they have since been the primary causes of losses.—D. C. Kennard and V. D. Chamberlain in *The Bimonthly Bulletin*, O. Exp. Sta.

The Palomino

By VERNE A. SCOTT,
Stephensville, Texas

When the forty-niners invaded California by the thousands in search of gold, they found besides the yellow metal another gold —one whose value sons of the forty-niners are beginning to realize today. Galloping on the big ranchos or ridden through the streets by the California dons, they saw golden horses — splendid, aristocratic creatures prized by their owners. Those were the palominos, symbolically called "Las Ysabellas," horses of the Queen. Those horses of Old California were at that time incontestably the finest in the world.

Forgotten for years, the golden horses are today attracting increasing attention from American horsemen. The only wonder is that they were neglected for 80 years.

The palomino has always appealed to the imagination. In the ideal type, a golden-coppery horse with silver mane and tail; white markings on its fine legs and a white strip on its face; a small, clean cut head with pointed ears, the horse gives an impression of great vitality and endurance. Beautiful, spirited, intelligent, the "Golden Ones" are coming back. In parades and fiestas in California, in fairs and shows all over Texas, palominos were shown this year. Some of the animals exemplified the finest traits of palominos; others had nothing except their color to put them in the palomino class.

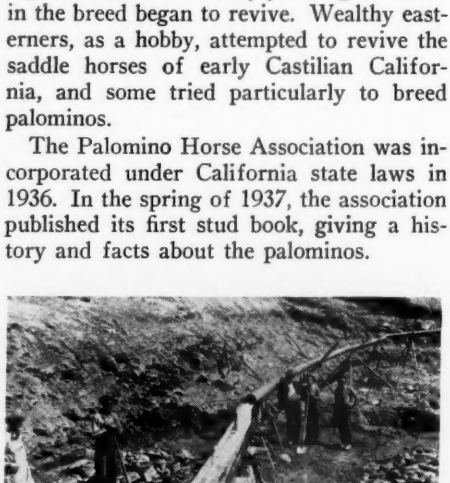
It has taken wide searching, careful breeding and great persistence to redevelop the perfect type of golden horse after its long submergence following the California gold rush. At that time the Yankees pouring into California, looking upon the palomino saddle horse as too small, crossed the valuable native blood with harness horses and even with draft animals. Of course, true palominos began to disappear.

Cortez had brought the palominos to the New World, and later others were sent to the Spanish dominions of the West. In Mexico they became so prized that it was an accepted gentleman's agreement that the Golden Ones, the Ysabellas, could not be sold. Only as a gift from one caballero to another could they change hands. From Mexico the golden horses went to the prairies of Texas, across the desert to Arizona, and finally into California.

Scattered stories remain from the years of their submergence. "Sam Houston rode a golden stallion captured from the troops of Santa Anna." . . . "In its early days the King ranch owned a small string of palominos." . . . "The charger of the Emperor Maxmilian, a golden chestnut Barb given him by the Bey of Algiers, was brought to Texas by the emperor's groom, and founded a strain whose studs have sired many fine palomino horses."

However true these tales may be, certain it is that the palomino grew progressively rarer as the result of indiscriminate breeding. Then, almost twenty years ago, interest in the breed began to revive. Wealthy easterners, as a hobby, attempted to revive the saddle horses of early Castilian California, and some tried particularly to breed palominos.

The Palomino Horse Association was incorporated under California state laws in 1936. In the spring of 1937, the association published its first stud book, giving a history and facts about the palominos.



Gold Mining
Horses are used around mines, for hauling, packing supplies and for general handy work. This picture shows a small outfit, with the water coming through the sluice box. The ore is thrown in this box, and, as the water carries the sand and debris away, the heavy gold sinks to the bottom. These men were averaging about ten dollars income a day apiece, and had found several nuggets worth around a hundred dollars.

Nutritional Blindness in Steers

By S. H. McNUTT, Ames, Iowa,
Iowa State College
and J. F. WALL, Ft. Dodge, Iowa
Iowa Department of Agriculture

THE purpose of this report is to record nutritional blindness of cattle in the Cornbelt, where such a condition rarely occurs. Jones, Eckles and Palmer[1] in 1926 and Bechdel, Honeywell and Dutcher[2] in 1928 reported that lack of vitamin A resulted in xerophthalmia, respiratory troubles and failure to grow. Converse and Meigs[3] in 1931 found that when cows were fed a poor quality timothy hay, as their only source of roughage, they failed to reproduce or gave birth to dead, weak, or blind calves. This was true even though yellow corn was fed.

In 1935, Moore, Hoffman and Duncan[4] reported 24 cases of nutritional blindness in calves and growing animals. The condition was characterized by dilated pupils and absence of inflammation of the external structures of the eye. It was often associated with weakness, paralysis, spasms and poor reproduction. There was atrophy of the optic nerve in the optic canal. In this case also the animals were on poor roughage. The authors report that the condition differed from the usual vitamin A deficiency or cottonseed meal toxemia. Kuhlman, Gallup and Weaver[5] in 1936, found that calves on a vitamin A deficient ration developed two types of blindness. One was temporary and was, apparently, the typical vitamin A opthalmia "associated with loss of appetite, bulging and watering of the eyes, grayish discoloration of the eyeball, ulceration of the eye, inflammation of the white portion of the eyeball, running at the nose, a rough, harsh coat, arched back, swollen joints, and convulsions." The other type of blindness was permanent and could develop independently of the first. In this the pupil was dilated but there was no visible ophthalmia. The eyes appeared normal. This condition is apparently identical to that reported by others in which there is a degeneration of the optic nerve with or without partial occlusion of the foramen by bony growth.

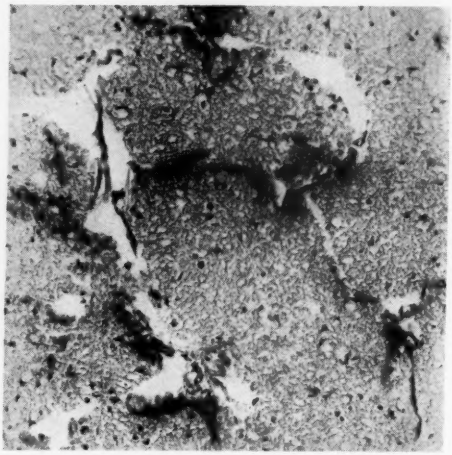
In 1937, Hart and Guilbert[6] summarized their work and conclusions. They list a variety of conditions in cattle that they feel are due to vitamin A deficiency. Among these conditions are night blindness, total blindness, degeneration of the optic nerve, stenosis of the optic canal, inflammation of the external eye structures, calves blind at birth, degeneration of nerves other than the optic nerve, weakness, spasms, paralysis and abortion. When the epithelial structures of the digestive system are affected the most common symptom is diarrhea. When the lungs are affected there is pneumonia and abscesses of the lung. Males may be temporarily sterile. There may also be a degeneration of the epithelium lining of the renal tubules.

THE blindness reported here occurred in one lot of steers. The same trouble occurred the year before in feeder cattle in dry lot, but not in breeding cattle on grass. The animals were fed a grain mixture of yellow corn 10 parts, oats and barley three parts and a commercial protein concentrate three-fourths of one part. Oat straw was used as roughage. The disease affected the entire lot of 90 head. Some would show an indisposition and soon the entire herd would be off feed for a few days. The symptoms would then gradually subside, but in five or six weeks the animals would have a recurrence of the trouble and pass through the same cycle. After each outbreak, one or two would be completely blind. Ten of the steers lost their eyesight entirely and in several others the sight was impaired. Some of the blind steers were finally the best conditioned animals in the lot. They learned to find their way to feed and water without difficulty. Symptoms during the acute stage of the disturbance were: loss of appetite, a dry, scabby nose and discharge from the nasal passages. A diarrhea sometimes developed later. Aside from blindness or impaired sight, the animals showed no symptoms between attacks.

They were on feed for six months and made an average daily gain of nearly two pounds.

Two of the blind animals were slaughtered under federal inspection and the tissues examined. At the time of slaughter neither animal showed symptoms of disease aside from total blindness. Because considerable yellow corn was fed, vitamin A deficiency was not suspected and some lesions might have been overlooked. Those in charge of the herd thought the condition was caused by an infection and an effort was made to find it. If such had been present it had disappeared, because the disease could not be transmitted to calves and cultures remained sterile. Examination was made of most of the internal organs. Some slight changes were found, but these did not appear to be of any significance. For instance, some hemorrhage and dilation of the small blood vessels and capillaries were observed in the liver of one animal, but not of the other. Sections for microscopic study showed the condition of the one liver to be identical to the so-called "sawdust" liver. Sections were also made of the spleen, various parts of the brain and cord, the kidneys, intestines, and lacrymal gland without finding any significant changes. Thus the lesions were confined to the optic nerve and, in one animal, structures about the optic nerve, also showed lesions. In one animal the fat at the base of the eyeball showed many petechiæ and congested areas. The lacrymal glands were congested and showed some hemorrhage. The optic nerves were twisted, bent and uneven in diameter and appeared yellow through their coverings. When the optic nerves were cut or nicked, a thick, creamy, homogeneous material oozed out and when the nerves were cut across, the same material was seen to fill the sheaths. There was also congestion about the nerves. The eyeballs themselves showed no changes. In the second animal there were no lesions in the fat of the orbit or of the lacrymal gland. The optic nerves showed the same bent, uneven condition. When cut across, the thick mucoid material was not present. This animal was a case of longer standing and it was thought that the mucoid material had been resorbed. Microscopic study of sections of the optic nerves showed complete destruction of the nerve fibers. Only the supporting structures remained intact. There was no evidence of inflammation.

THE foregoing findings, together with absence of inflammation, strongly indicate that this type of blindness is nutritional. This blindness, without external visible lesions, appears to be identical to that described by Kuhlman, Gallup and Weaver, and others. All who have worked with a like condition agree that it is nutritional. It is often reported in calves known to be deficient in vitamin A and for this and other reasons some are inclined to believe that it is caused by vitamin A deficiency. On the other hand, for example, Bessey and Wolbach[7] contend that it has not yet been shown that lack of vitamin A can result in nerve lesions. Also this type of blindness is seen in young cattle that are being fed yellow corn. In these cases the roughage offered is usually, if not always, poor. In the case reported here the roughage consisted of oat straw. It should be



Cross section of the optic nerve of a blind steer. The larger clear spaces are due to shrinkage in preparation and the large dark shaded areas are artifacts. The nerve bundles lie between these. The small dark spots are nuclei of the supporting structures. The small clear areas represent spaces where nerve fibers had been, all of which are destroyed. X132.

mentioned that the corn fed this particular lot of steers was of poor quality. It was moldy and partly spoiled. It is questionable whether or not such spoilage would destroy its vitamin A content. Thus, although our knowledge is imperfect, one can be reasonably sure that this type of blindness can be prevented. Animals should receive a grain mixture known to be fairly rich in vitamin

A. T. Peters, 1868-1938

A. They should also receive good quality hay.

It is not yet fully known whether or not the vitamin A or provitamin A content of good hay is the only factor involved in blindness of cattle. Treatment of advanced cases here reported is useless. The nerves are destroyed and nothing can make them grow again. In the Cornbelt, yellow corn and good hay are usually fed. This, apparently, accounts for the fact that the type of blindness observed here is rare, but doubly confusing when encountered.

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Albert T. Peters

Albert T. Peters, 70, died at his home in Peoria, Illinois, September 11, 1938, after an illness of several months. Doctor Peters was born in Chicago and educated in Germany. For 16 years, he held the chair of animal pathology at the University of Nebraska. In 1909, he returned to Illinois to establish the State Biological Laboratory and in 1912 was appointed Chief Veterinarian of the State Department of Agriculture, in which position he remained until 1920, when he removed to Peoria and, together with Mr. Paul S. Casey, organized the Vitamineral Products Company.

After retiring from the office of State Veterinarian, Doctor Peters devoted much of his time to boys' improvement work, serving as scout master and on various Rotary International, Masonic, Y. M. C. A. and other committees for underprivileged and crippled children. He was responsible for the Big Brother movement in Illinois and sponsored scores of boys convicted of delinquencies and other minor infractions of the penal code.

During the period of his veterinary activities, Doctor Peters was always a national figure and was prominent in the Nebraska Veterinary Medical Association, the Iowa-Nebraska Veterinary Association, the Missouri Valley Veterinary Association, the Illinois Veterinary Medical Association and the A. V. M. A. He was founder and editor of the *Iowa-Nebraska Veterinary Bulletin* and of the *Missouri Valley Veterinary Bulletin* during the first year of its publication.. This publication ultimately became VETERINARY MEDICINE.

He is survived by his widow, two daughters, Mrs. Carl T. Meyers of Springfield and Mrs. Paul S. Casey of Peoria, and four grandchildren.

* * * *

Besides vitamins D_2 and D_3, there is evidence of at least eight other forms of vitamin D which can be produced through the treatment of natural products, or of products made in the laboratory from various sterols.—*Vitamin D milk*, 5:6.

The Control of Mastitis in New York State*

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D. H. Udall

IN accepting this invitation to present the subject of mastitis we assume your chief interest is in the work in New York State and this is what we shall attempt to describe. As in all dairy districts, mastitis with us has become a disease of primary importance and there have been urgent requests from farmers for relief from the losses that it incurs. We presume there are differences between the conditions in Great Britain and America, but there can be little difference in the underlying principles.

In New York State mastitis is important because of economic loss from diminished milk production, and because of rejection of cows by inspectors who pass upon their fitness to produce market milk under municipal or state sanitary codes. Under regulations of the New York City Board of Health, for example, an annual certificate of health must be obtained from a veterinarian for all cows producing milk for the city market, and in some of the adjacent cities in the Metropolitan Area, such as Newark, New Jersey, physical examinations twice yearly are required of producers of grade A milk. Similar regulations for other parts of the state are provided in the state sanitary code. In addition, the milk companies who purchase, pasteurize and distribute milk inspect the product from its source to its destination. When delivered at the collecting station from the farm it is examined for odor, admixtures, temperature and cell count. When abnormal conditions are found, such as pinpoint colonies on standard plate counts, or long-chained streptococci or leucocytes in smears of non-incubated milk from weigh-can samples, mastitis may be suspected. In herds producing certified milk monthly examinations are required, and quarterly examinations are made by certain companies that produce grade A pasteurized milk. Rejections under the New York City Regulations are said to run 1% to 5% yearly. And there are many farmers outside inspection service whose operations are conducted at a loss because from 25% to 40% of their cows have chronic mastitis in an advanced form. Replacement of cows under the tuberculosis and abortion control programs has increased the sales of cattle, especially at auctions, and many cows rendered worthless for milk production because of chronic advanced inflammation of the udder have been included in the purchased additions. Even cows condemned because of mastitis have entered other herds after a long or short trip in a truck.

THE result of this situation was an appropriation of $5,000.00 to the Veterinary College for a study of the problem: and because of opportunities for contact with many herds through the ambulatory clinic it came to the department of medicine. In 1929, one of us (S. D. J.) was assigned to this work. Our first effort was a clinical study of several large and small herds and a laboratory study of the milk, for purposes of information. We had no theories and no definite program. In 1936, additional funds provided a second person, giving one for the laboratory and one for the field.

There was soon noted a close agreement of the decisions reached in the stable and in the laboratory, and also that two persons

* Presented at the 56th Annual Congress of the National Veterinary Medical Association of Great Britain and Ireland.

working independently would classify udders alike according to the fibrosis and atrophy. Since the degree of mastitis is so variable that the word used alone is indefinite, udders were classified, chiefly according to the degree of fibrosis, as numbers 1, 2, 3, and 4. Numbers 1 and 2 are excellent or normal; number 3, fair; and number 4, chronic advanced mastitis. Comparative laboratory examinations of the milk revealed almost no infection in class 1 and 2, a medium rate in class 3, and a high rate in class 4. The amount of infection was also found to be higher in class 4. It was concluded that these cows were the chief source of contagion and that their removal from contact with the herd would have a restraining influence upon the spread of the disease. In herds containing a high rate of advanced cases, infection is more widely distributed among the class 3 cows. These views have been supported by numerous observations which will be described.

EXAMINATIONS in the stable apply to size of herd, age, quality of stables and attendants, care of animals, history with respect to mastitis, and whether additions are natural or by purchase. Examination of the individual cow includes appearance of the milk in test tubes, on the strip cup, on the bromthymol blue test for alkalinity, and occasionally on the field chlorine test. After milking, the udder and teats are examined for asymmetry and fibrosis, though in light producers previous milking may not be necessary. Examination of the stable refers to the length and width of the stall bed, partitions between cows, type of stanchions, bedding, use of lime or superphosphate on the back part of the stall beds, cleanliness, position of doors and other intakes near stanchions, and whether the yard is so muddy that the teats drag through filth. When milk is taken for laboratory examination, quarter samples of the first streams are drawn.

Cows under observation for purposes of study are examined according to the formula in Table I.

TABLE I

Third calf born September 5th, 1937. Examination, May 6th, 1938. Born March, 1933.

	LH.	LF.	RH.	RF.
1. Milk	—	—	—	—
2. Bromthymol blue	—	green	—	green
3. Chlorine field test	+	+	+	+
4. Milk incubated 24 hours	—	FLAKES	—	SEDIMENT
5. Blood agar plates	staph	STREP*	coryn	STAPH
6. Smears, 24-hour incubation	staph	STREP	staph	STAPH
7. Cell count	1,600,000	4,300,000	3,200,000	XXXXa
8. Fibrosis	Distinct	Distinct	Slight	Distinct +b

* *S. agalactiae*, weak beta; a, too many to count; b, class 3 udder.

When few bacteria appear on a blood agar plate, it is recorded in small letters (strep) which indicates approximately 1,000 per cubic centimeter. When there are many, it is written in capitals (STREP), indicating 5,000 or more per c.c. A report of very many means 500,000 or more.

These observations give comprehensive information on the extent of the lesions, the degree of infection, and the character of the milk. In the interpretation of the results of examination of milk, one needs to consider its variations. In the first month of lactation, for example, and especially within the first two weeks, milk from a badly diseased udder of a heavy milker may be normal to all of the various tests, including the bacteriological, or it may be abnormal. Because of the number of tests that may be applied to milk a comparison of the relative value of such methods has become a popular study, and a tabulation of the results may be confusing. If the percentage of infection among cows reacting to a test is only 70, for example, this method alone will hardly indicate whether or not a reactor is in the 70% or the 30% group. The value of a diagnostic method is

judged by what it tells about the patient under examination, and not by what it has told about the average.

MILK is examined on the strip cup, or on a black sheet of bakelite slanted into a baking tin, or in test tubes held to the light. Abnormalities vary from a slight watery appearance in the test tube, which is of slight significance, to that of flakes, clots, or pus of various amounts and consistency, which is highly important.

THE bromthymol blue test is made after the first ten or twelve streams have been discarded. Reactions are read as light green, green, or dark green. An orange reaction results from increased acidity and it is only seen when added to milk that is obviously bad. With proper regard for the lactation period, reacting quarters are regarded as suspected, and usually other evidence of mastitis is present, but no conclusion should be reached on this test alone. Milk may be alkaline when a non-infected quarter begins to dry off for no apparent reason, from a slight contusion, from a transient staphylococcus or other noncontagious infection, or from a case of *S. agalactiae* mastitis. Inspectors find it useful for the detection of cows that are drying off.

THE field test for chlorine is thought by some to be too sensitive for practical use. When milk is entirely negative to this test, the udder is usually above suspicion. It is of value in the purchase of cows. Reactions occur early in the advanced lactation period.

INCUBATION of milk for 24 hours at 37° C., is a simple and useful method of testing milk from a suspected quarter. When certain types of deposits are formed, *S. agalactiae* is almost invariably present, fig. 1.

A HIGH cell count may rarely be in the millions and transient from no apparent cause, and it is normally high in late lactation. With proper regard for the lactation period, the cell count is highly useful

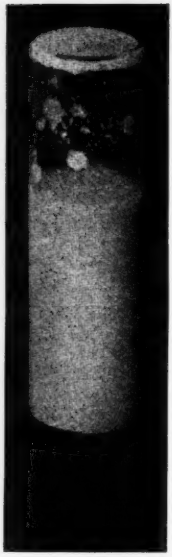


Fig. 1

in the determination of the presence and the extent of inflammation of the udder. It is high when cows decrease rapidly in milk flow from a disease, such as winter dysentery. Often it is especially high in mild transient or constant staphylococcus infections. The degree of mastitis and the prognosis may be judged somewhat according to whether the count is in the two millions, the five millions or the ten millions. There are individual exceptions, however, so that no definite number alone can be accepted as a diagnosis of mastitis.

BACTERIAL examination of milk has been made, following methods in general use; these are described in the *Cornell Veterinarian* for July, 1938. Our observations agree with those commonly reported, that in badly diseased herds *S. agalactiae* is usually the predominant infection. Groups II and III, Minett, Stableforth and Edwards (*dysgalactiae* and *uberis* of Diernhofer), are recovered from nearly every herd, and, similar to staphyloccocus infections, they appear to be noncontagious, rather transient and less pathogenic than *S. agalactiae* (type I). But occasionally the infection is severe. Data from 18 herds and 648 cows are presented in Table II to illustrate variations in the distribution of infections.

Herd 1 was infected only with staphylococci, yet there were four cases of advanced clinical mastitis (class 4 udders). Milk from herds 2 to 8 yielded only Groups II and III streptococci, while milk from herds 9 to 18 yielded all three groups. In these herds the rate of infection with miscellaneous streptococci other than agalactiæ is shown to be essentially the same

TABLE II

Herd	Cows	Infected Cows	Distribution by Quarters					
			Agalactiae Group I	Dysgalactiae Group II	Uberis Group III	Others	Unidentified	Staphylococci
1	16	8	0					16
2	17	1	0	1				
3	13	1	0	1				
4	29	3	0	1		1	1	
5	11	2	0		1		1	
6	20	3	0				4	
7	23	4	0		4	1		
8	9	1	0		2			
9	181	29	24	7	10	4		
10	25	6	6					
11	73	14	17				2	
12	131	22	39	2	3	3		
13	18	5	7					
14	19	6	2		4	2		
15	14	10	10	4	1		2	
16	9	7	9				2	
17	17	7	19			2		
18	23	17	27				3	

whether or not agalactiae are present, and there is no essential difference between the rate of infection and the number of animals in the herd.

The effect of supervision upon different groups of streptococci in these herds is shown in Table III.

TABLE III

	Total cows	Infected cows	Per cent infection	Size of herds
Groups II and III, herds 2 to 8, supervised.....	125	15	12	10-30
Groups I, II and III, herds 9, 11, 12, supervised	385	65	17	75-175
Groups I, II and III, all others supervised.....	125	58	46	9-25

Table III shows that the first effect of supervision was to reduce the rate of *S. agalactiae* infection, and that where the rate of *S. agalactiae* infection was high, the rate of miscellaneous streptococci infection was relatively low—herds 10, 11, 13 and 18, Table II. Apparently a high rate of agalactiae infection either displaces or overwhelms other types. This suggestion arises when a quarter infected with staphylococci begins to yield streptococci, and when a quarter treated with trypaflavine for streptococcic infection, thereafter yields only staphylococci. In badly diseased herds the chances that an advanced clinical case of mastitis is caused by *S. agalactiae* are greater than if such an udder is identified in a relatively clean herd. In supervised herds, *S. agalactiae* is readily controlled; perhaps this is due to a restricted habitat in the udder. Often the rate of contagion is slow, and apparently the period of incubation may be long and uncertain. The Group II infections in herd 9 were chiefly in heifers and young cows.

We have no evidence that Group I becomes permanently established in the stable, except in the udder. It is probable that milk from udders which discharge freely through a patent teat orifice does contaminate the floor, and that *S. agalactiae* infection may survive here long enough to reach other easily infected quarters. It is doubtful, however, that such survival is permanent; it may be continuous if there are enough spreaders. Groups II and III, on the other hand, appear not to be restricted in their habitat, nor do they appear to spread by contact. This view is sup-

ported by the observation that they continue to be recovered from herds 2 to 8 regardless of strict sanitation, and that *S. agalactiae* is not recovered from the milk of these herds where sanitation is not observed. This view is further supported by the observation that *S. agalactiae* in each herd is distinctive for the herd, being nonhemolytic, green, narrow-zone hemolysis, or weak beta; one or the other of these types predominates.

In the diagnosis, identification on blood agar plates is highly desirable, and such information should be available to the veterinarian, who often needs to know whether a diseased udder harbors staphylococci only, or *S. agalactiae*. While he may determine this point for himself by means of smears of incubated milk, his conclusions are at least less authoritative and they may be less reliable. The course and prognosis vary with the type of infection; Groups II and III and staphylococci are sometimes transient or limited to a single lactation, and in the case of pure-bred animals this information may be of great value. Furthermore, complete information of a case adds to its interest and to the knowledge of the disease.

PHYSICAL examination of the milked-out udder for fibrosis, atrophy, or other changes, combined with examination of the milk for physical changes, alkalinity and possibly chlorides affords an accurate and practicable method of diagnosis. Reference has been made to the relation between the extent of the physical changes and the degree of infection. This relation may vary according to the percentage and intensity of infection in the herd, but in any case the method is adequate. Observations are first made for asymmetry, flaccid sphincters and patent teat orifices. If milk flows on slight touch of the teat or quarter, infection is probably present, for it is impossible to avoid invasion of such quarters. The condition may be natural or acquired from injury. The teat is then palpated for lesions in the duct.

An outline of the method of observation and palpation of the udder is illustrated in figures 1 to 8, plate I.

Fig. 1. Observe the rear quarters for the presence of atrophy.

Fig. 2. Observe the front quarters for atrophy.

Fig. 3. Palpation of cisterns. Raise the quarters together simultaneously to compare the consistency and weight by lightly raising and palpating the tissues in the region of the cisterns with the finger tips. There may be a distinct variation in the weight, firmness and surface which reveals fibrosis in one as compared with a normal soft glandular structure in the other. Variations here suggest the probable findings throughout the quarter.

Figs. 4 and 5. Method of locating circumscribed areas of fibrosis in the ventral part of the quarters. Grasp, but do not stretch, the teat with one hand and compress the tissues with the other. In a normal, elastic quarter the opposing thumb and fingers are separated chiefly by the opposing layers of skin. In fibrosis they are separated more or less by a firm mass. The degree of fibrosis is estimated by the difference between the two hind quarters and the two front quarters both anterior and posterior to the teats. But do not compare front quarters with hind quarters.

Fig. 6. Superficial palpation of the surface. With light compression the skin is raised in folds while the finger tips glide over the underlying surface to detect the degree of smoothness. The presence of distinct coarse lobulations indicates fibrosis.

Fig. 7. Grasp the quarter firmly with both hands, which are moved back and forth under firm compression to detect lobulations and consistency. The tissues are alternatively compressed and relaxed. The degree of atrophy and consistency are also judged by lifting each quarter with both hands to compare the weight, elasticity, and size. Coarse, irregular lobulations are of greater significance than fine lobulations uniformly distributed.

Fig. 8. Examination of the ends of the teats for patent meatus, relaxed sphincter, and ease of milking.

The findings on each quarter are recorded as follows:

—, the quarter is entirely normal.

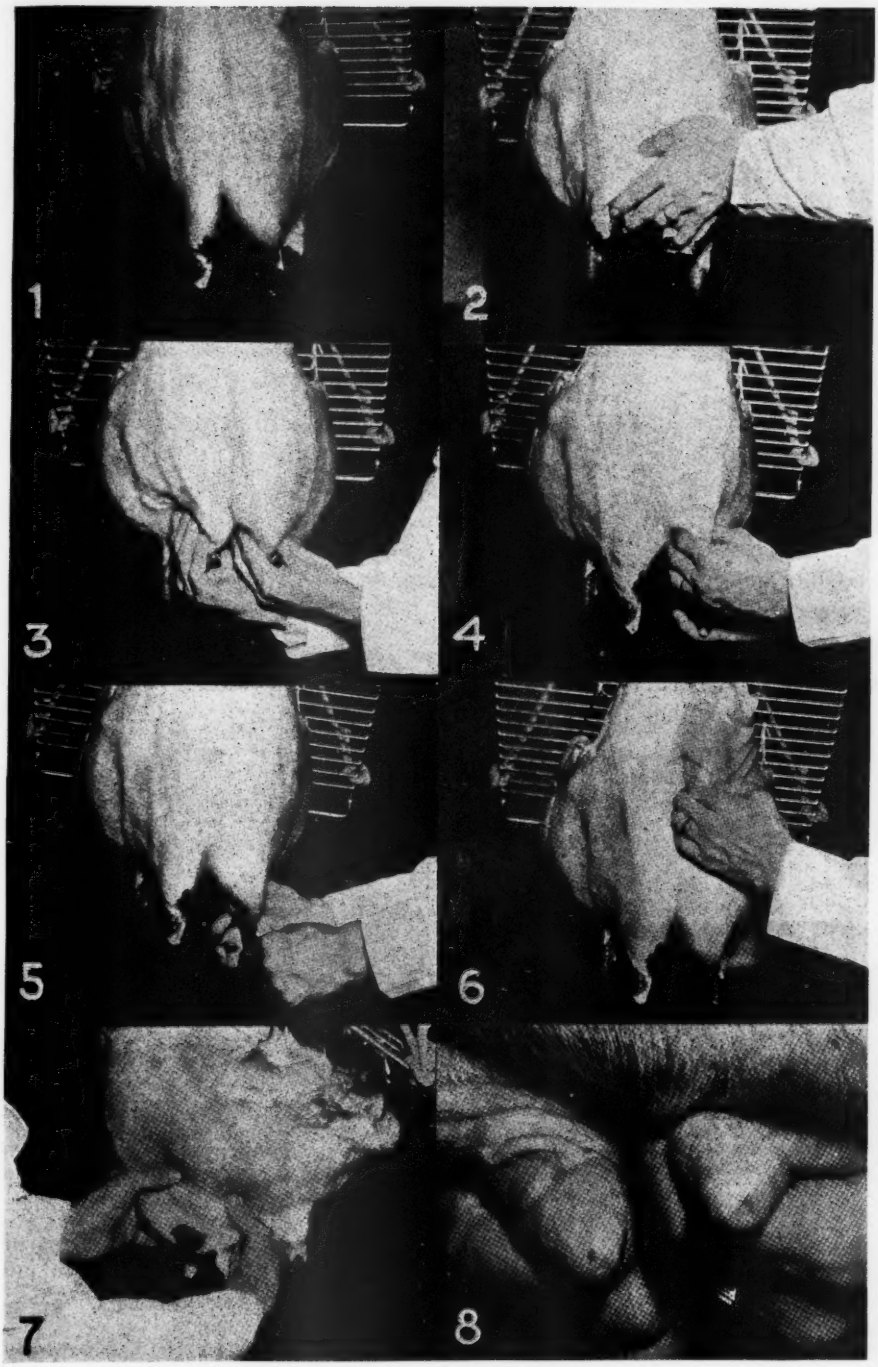


Plate I

S, fibrosis is slight or suspected. There are single indurations not more than one or two inches in diameter.

D, fibrosis is distinct; Da, with slight atrophy. DA, with marked atrophy; Da lob, with coarse lobulations; D+A lob E, very distinct with marked atrophy, coarse lobulations, and relaxed sphincter. There is multiple fibrosis or a single induration approximately two to three inches in diameter.

M, fibrosis is marked. Disseminated or diffuse extensive indurations have largely replaced the glandular tissue.

The plus sign indicates an intermediate degree, as S+, D+. Udders of first-calf heifers are normally firm, and the individual quarters are sometimes marked *D*. With sufficient practice, one may be able to classify udders of non-lactating cows. When the udder is congested, tense, and edematous in relation to parturition, it is not suitable for examination. If an udder is edematous, or "doughy," unrelated to parturition, it is severely judged.

UDDERS are classified as Numbers 1, 2, 3 and 4, according to the following specifications:

No. 1. The udder is normal in every respect and is uniformly symmetrical.

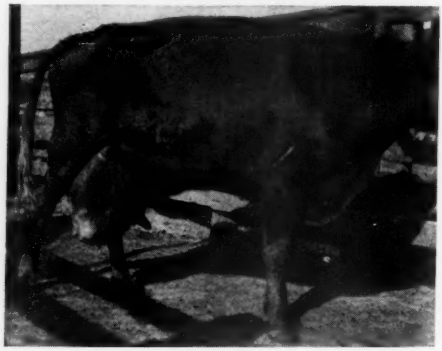
No. 2. The milk production is normal in amount and quality. In a few the strip cup may occasionally show scattered pin-point flakes. The alkalinity is usually normal. Fibrotic lesions are few and slight or single and distinct. An udder with two distinct quarters, but otherwise normal, may be classified as 2+. Laboratory examination of milk from distinct quarters may reveal staphyloccocus or other low grade infection with a cell count in the low millions.

No. 3. Production usually is normal. There may have been previous acute attacks. At times the milk may contain flakes or clots or appear watery. The alkalinity may be increased, especially at the beginning or the close of lactation; indurations are distinct in more than one quarter, or are distinct in one quarter in combination with a persistent bromthymol blue reaction. If a quarter constantly gives distinctly abnormal milk and shows infection the udder may be classed as 3+ or 4. Often there is a low grade infection and a high cell count.

No. 4. Production is below normal. Often there have been repeated acute attacks. Usually the milk contains flakes or clots and is watery. The alkalinity and chlorides are increased. Fibrosis is distinct and multiple or marked and diffuse. Atrophy and asymmetry are frequent. If the lesions are marked in two quarters the udder is classed as No. 4, even if the milk is temporarily normal. If a quarter leaks freely the udder is classed as No. 4. Laboratory examination reveals infection, and cells are present in the millions.

That spread by contact may be slow is shown by our small experimental herd where no precautions have been taken and no new case has developed in three years. It is a matter of observation, however, that occasionally infection may spread rapidly after the addition of a purchased cow. Whether this is due to an unusually virulent type of infection, or to a poorly fitting cup on the milking machine is not known. Probably there are variations in the virulence of different types or strains.

The care and feeding of the cows exerts an influence on the activity of the infection. If cows are fed lightly, the degree of infection revealed in the milk is low in comparison with the degree of fibrosis in the udders. Thus conservative feeding of mastitis



In a normal udder the quarters are elastic and free from coarse lobulations.

cows improves the quality of milk and the performance of the unit.

While only slight reference has been made to the symptoms, it is important to consider that mastitis caused by Groups II and III streptococci and by staphylococci usually is of a lower grade than that caused by Group 1 streptococcus. In these low-grade infections recovery often occurs, and consequently one should be conservative in the prognosis of such cases.

Control

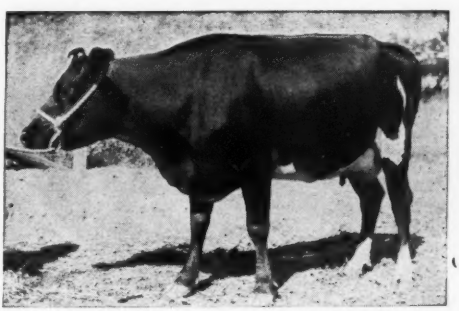
Bacteriological examination of the milk for *S. agalactiae* (Group I) has been regarded as an essential step in the control of mastitis. Our observations during the past nine years agree with the prevailing belief that usually in badly diseased herds this is the predominant cause. This appears to be true of any group of cows affected with fibrosis in an advanced form whether they are individuals assembled from comparatively clean herds, or groups of cows found in badly diseased herds.

While bacteriological identification of the milk of cows harboring *S. agalactiae* is regarded as desirable in the control of mastitis in a herd, it is not regarded as essential. By means of such examinations it is possible to identify and reject infected cows, as one rejects cows on the tuberculin test. But there are such essential differences in the habitat and virulence of the organism, the channels of spread, the mode of infection, the degree of contagion and the relationship in general between the infective agent and the cow that methods essential to the control of other chronic diseases are not essential here. Observance of stable hygiene, for example, has little influence upon the spread of tuberculosis, but it has profound influence upon the spread of mastitis. In mastitis the most important influence is stable and milking hygiene. Mastitis is not caused by a specific infection, except in definitions which specify one of the various bacterial causes. Reports in Tables II and III suggest that *S. agalactiae* thrives in the neglected herd, where milking and udder sanitation are ignored, and where additions are largely by purchase; it is a result of poor sanitation. This is shown in some of our large commercial milking herds where the turnover because of mastitis is extremely high each year. As cows are commonly purchased, mastitis is nearly always included in the sale. Table III also shows that in the three herds of 75 to 175 cows each, where all three kinds of infection are found, and where control is practiced, there is only a 17% infection in contrast to 12% in small herds from which *S. agalactiae* has either been eliminated, or was not found at the time of the original survey.

Removal of all cows yielding *S. agalactiae* involves an elaborate and expensive technique not generally available; it removes individuals from which the infection might disappear; there were six such individuals in herd 9, Table II; it imposes heavy cost by including many animals that are still high producers of milk of good quality; it discards cows that may be successfully treated; and it does not provide sanitary supervision.

It is highly desirable, however, that laboratory diagnosis be available to veterinarians engaged in mastitis control.

In general control the first requirements are good herd management and adequate sanitary supervision. The first step is to remove the advanced cases; which includes the class 3+ and 4 cows. In Table II, herd 9, this would have removed one-third of the infected cows and 43% of the quarters showing streptococci on blood agar plates. In herd 15 it would have removed eight of the nine infected cows. Herd 18 was an ex-



Inspect the udder for symmetry. The back teats should hang to the same level as should also the front teats.

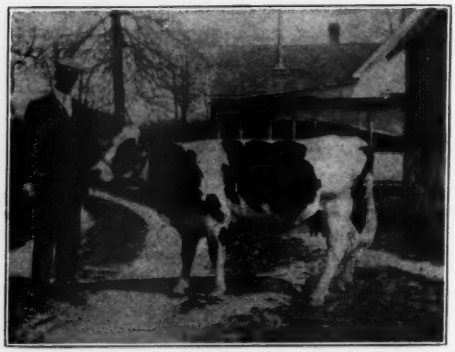
ception to the rule, since the rate of infection was about equally distributed between the class 3 and 4 cows. Conditions are not alike in any two herds, and this is one reason why sanitary supervision needs to be in the charge of a trained veterinarian.

THE following specific suggestions are given to the owner. Not all of these provisions are practicable in each herd. Measures that prove to be effective in one herd may not be sufficient in another, for the personal element is an important factor. Control is more readily accomplished in a privately owned herd than in an institutional herd, or where change of cows is frequent.

1. *Stanchion Classified Cows in their Respective Groups.*—The milking cows should be stanchioned according to their classification in the following order: Class 1 and 2 (clean group): class 3 (suspected group); and class 3+ and 4 (badly infected group).

2. *Use the Strip Cup Before Milking.*—When a cow shows watery milk, flakes, clots or pus repeatedly she should be removed from the milking line, particularly if she stands in a clean group. Early discovery of cases showing watery milk or pin-point flakes in the milk may save a cow. In the treatment of such cases, the grain ration is reduced immediately, the affected quarter or quarters milked hourly, and hot epsom salts packs applied.

3. *Washing Udders.*—Except in a few isolated herds only one method of washing udders can be recommended. Individual towels should be supplied for each cow. The towels are placed in a chlorine solution of a strength of 200 parts per million. When an udder is to be washed, the operator removes a towel from the pail and wrings it partly dry. After the udder is washed the towel is wrung dry, and the surface of the udder is wiped dry. The towel is dropped into a discard pail. The same operation is repeated for the next cow. All towels should be washed in a hot soap-suds water, wrung dry, and then placed in a chlorine solution (200 p.p.m.) in a crock until the next milking. The chlorine solution should be supplied fresh daily.



Compare opposite (right and left) quarters. They should be similar in weight, resiliency and lobulation.

4. *Milking.*—It is advisable to assign a group of cows to each milker who milks them each time. Since it is important that complete milking be practiced, the herdsman is expected to make personal examinations of milked cows frequently.

5. *Dipping Teats.*—Only a small amount of chlorine (half to one pint, having a strength of 200 p.p.m.) is necessary to dip the ends of the teats after milking. Dip the teats of 20 to 30 cows and discard the solution. Provide a basin constructed preferably of graniteware, porcelain, enamelware or glass and large enough to accommodate the four teats of an udder at one time.

6. *Washing Hands.*—Before milking each cow a milker should wash his hands with soap and water, disinfect them with a chlorine solution (100 to 200 p.p.m.) and wipe them dry, preferably with paper towels. Where milking machines are used, the milking cups should be dipped in water and then in a chlorine solution after each cow is milked.

7. *Do not Milk on the Floor.*

8. *Do not permit Wet-Hand Milking.*

9. *Disinfection of the Stall Bed.*—Once a week, the litter should be removed, the surface of the platform scraped clean and sprayed with a disinfectant. One may use a 400 to 500 p.p.m. chlorine solution, or a 3 to 5% hot lye solution, or a 3% liquor

cresolis compositus solution. In one herd this solution has been used twice daily.

10. *Provide an abundance of bedding.*

11. *Use of Lime or Calcium Superphosphate.*—Each day before it is swept the floor should be sprinkled with hydrated lime or superphosphate. Superphosphate may be sprinkled on the floor after sweeping.

12. *Heavy Producing Cows.* — Heavy producing cows of any breed will be less likely to develop mastitis and will produce more if milked three times a day.

13. *First-Calf Heifers.* — The milk of first-calf heifers should be examined for mastitis at the beginning of the lactation period. When the milk of a heifer is normal on the strip cup and the bromthymol blue test, she may be stanchioned with the clean group and milked first.

14. *Fresh Cows.*—A strip-cup and bromthymol blue test can be run on each cow within three to four days after freshening. If the milk of a cow that was a member of the clean group during the previous lactation is abnormal on the strip cup, or gives a green reaction to the bromthymol blue test, this cow should be withheld from the clean group until she is declared free of mastitis. Such an animal often proves to be a class 3 cow (suspect).

15. *Purchased Additions.*—Before purchase each cow should be examined for mastitis or other diseases. A veterinary certificate of health should be required for each animal. As an additional precautionary measure, the purchaser should handle such an animal as potentially dangerous to his herd until it is definitely determined that no udder trouble exists.

16. *Raising Calves.* — Provide milk for young calves from disease-free cows. Do not allow calves to suck each other habitually.

17. *Stall-Bed Construction.*—Provide an adequate stall-bed and partitions for each cow. Many injuries are caused by cows treading on each other's teats and udders because the stall beds are either too narrow or too short. Such injuries usually result in mastitis, and often in complete loss of the injured quarter.

INJURIES to the teats and udder, and operations upon the teats, heal more readily in herds from which *S. agalactiae* infection has been eliminated or in which it has been reduced, than in badly diseased herds.

A DETAILED account has been given of methods of examination of herds for purposes of study. From these observations it was concluded that examinations made on the premises are adequate to meet the diagnostic requirements of control. Under this system the udders are classified upon evidence revealed by the strip cup, the bromthymol blue test, and the physical examination of the udder, chief reliance being placed upon the physical examination. This plan was greeted with considerable scepticism, but this attitude was met with a proposal to give public demonstrations in badly diseased herds. After waiting nearly two years the owner of such a herd volunteered it for the purpose in February, 1934. From this beginning we have in the past four years surveyed 60 herds including 2,500 cows. In support of the system the farm bureau organization was successful in its request of the legislature that the appropriation for the work be doubled. In 1937, and again this year, we have given a short course on the subject to 20 veterinarians from Michigan, under the auspices of the Kellogg Foundation, in an effort to improve the quality of milk in certain counties in their welfare program in that state.

WITHOUT further details on the favorable reception of this program, one may claim that it has met the needs of the producer, the officials who administer municipal and state sanitary codes, the veterinarians who supervise the production of milk of high quality, and the consumer.

* * * *

For the detection of mastitis no one test on milk can be said to be better than another. Each test must be interpreted with relation to all the others.—*Udall.*

Administering Medicines to Sheep

To make the best impression on the client, one should be able to administer drugs or biologics in a quiet, skilful manner. To "grab" a frightened and sick ewe by the wool, and forcibly drench her with a nauseous mixture amid struggling and choking may terminate in disaster.

Passing the stomach tube.

PROPER METHOD OF DRENCHING

In drenching a sheep its head should not be raised very much above the level of its back and its nose must not be extended, entailing difficulty in swallowing. Suffocation from the liquid going to the lungs is the penalty for disregarding this admonition.

Sheep owners, as a rule, are progressive farmers, and may become good, paying clients once the practitioner gains their confidence. Unskilled handling of their animals is *not* the way to gain the confidence of sheep men.

For Impaction in Sheep

As a rule, salines act in sheep much as they act in the cow, i.e., they merely inflame the mucous membrane of the rumen and "go round" the impaction. In addition they often cause septicemia in ewes heavy with lamb. However, one can try one-half a small rumen (bovine) tablet crushed and mixed with molasses, syrup or honey and given as an electuary. This can be repeated in twelve hours. If the animal has had some salt rubbed over its tongue so that it will drink copiously, so much the better.

Dystocia in Sheep

We handle this trouble much like we handle dystocia in the cow. We use the same obstetrical chains, wire puller, and pay special attention to the position of the ewe.

Do not be afraid to perform embryotomy where the dystocia is due to extra large or dead lambs.

Administering a small dose of glucose and calcium gluconate will often tide the ewe over a difficult dystocia.

Sheep and Goat Lice

Recently, the Texas Agricultural Experiment Station has developed a treatment for lice of sheep and goats which has been demonstrated to be superior to other methods now in common use.

Wettable sulphur	10 pounds
Trisodium phosphate	1 pound
Water	100 gallons

The flock should be dipped at 11-day intervals, and each animal should be immersed at least four times.

T. O. Booth.

Fort Worth, Texas.

Protection for Baby Lambs

Pneumonia frequently occurs in lambs, nearly always from chilling. Treatment is generally unsuccessful, but the disease may be prevented through the use of hot water jugs or milk cans filled with warm water and placed in a box or barrel, thus furnishing the lambs with a brooder. Valuable lambs may be protected by using wide flannel belly bandages held in place with safety pins over the back for a couple of days.

A "Bum Lamb" Western parlance for orphan lamb.

The first four days are a critical period in the life of the average, early-winter lamb. If the lambs are weak when born it often indicates that the feed of the ewes has been deficient in some of the essential minerals, food elements or vitamins. Reinforcing the hay, if it is of poor quality, with cod liver oil and stock molasses often corrects this fault. The cod liver oil may be purchased at $19.50 per 30-gallon barrel and with the molasses diluted with hot water may be spread upon the hay with a spray pump.

W. H. LYTLE.

Salem, Oregon.

Utilizing Waste Lawn Grass

There is much fine forage that goes to waste during the early and dry, lean grazing seasons of the year in many grazing districts. A city of 300,000 people often comprises one of the largest irrigated areas in that section of the country. However, most of the grass crop raised thereon is wasted. The herd owners and lawn owners would both benefit greatly by a well-organized and systematic gathering and utilization of the lawn grass clippings.

Salem, Oregon. W. H. LYTLE.

Handling Infectious Diseases of Sheep

1. Isolate the apparently healthy from the sick sheep. Drive them through an antiseptic solution. As sheep do not like to wade in water, place chopped straw in the vat or trough.

2. Select a seriously affected animal, sacrifice and perform a post-mortem examination. If reasonable doubt remains about the clinical findings, send specimens to a laboratory for further examination.

3. Burn the carcasses of dead animals.

4. If the disease is hemorrhagic septicemia or similar to it, give the healthy animals a 3cc dose of bacterin in axillary space; five days later, give a 2cc dose of aggressin. In cases showing clinical symptoms, one may give 10 to 20cc doses of anti-hemorrhagic septicemia, but do not expect too much from this treatment as it is not successful in the majority of cases.

5. Collect your fee while the owner is still in a grateful state of mind.

Sheep Problems in the Southwest

During the past few winters, a considerable quantity of mixed infection bacterin (ovine) has been used in New Mexico sheep for pneumonic disturbances, attended with inflammatory conditions of the intestinal tract. Moving of these bands does not, alone, control the condition. However, with the addition of the mixed bacterin, prompt control results.

New Mexico sheep raisers generally are not alert to the value of proper veterinary service. Sheep have been run, largely, on the open range for years. Heretofore, in this dry climate conditions have been unfavorable for the development of epizootics or the rapid spread of certain parasites.

TOM SNELL.
State Sheep Inspector.
Albuquerque, New Mexico.

Foot-Rot

One reason for so many failures in the treatment of genuine foot-rot is lack of thorough surgical excision of the necrotic material.

When called to see a small outbreak of this in the average farm flock, don't leave a little disinfectant, and tell the owner "to run 'em through this." Instead, after making an examination of the animals at a distance of about ten feet, pick out a good

Thoroughly trimming away all necrotic tissue is the first step in the treatment of foot-rot.

place for the operating work. Put on the most elderly pair of trousers, overalls, coveralls or rubber pants you may possess, and also rubber gloves.

Have several knives, not razor-sharp, ready, with a pan of good aromatic disinfectant, and a couple cans of good, penetrating antiseptic oil.

One can take the sheep, and set it on its rump, and lets its back rest against your knees, or have the owner hold it. The lame feet are then trimmed thoroughly; all the necrotic material being removed, and the interdigital gland opened up. Have a can of astringent dusting powder and a pair of hemostats handy if a blood vessel is nicked.

After all the feet have been attended to,

Individual Treatment of Foot-Rot

have the hired man hold the animal's foot in a small can of oil about three or four minutes.

If the animal is extremely lame, we mix up an electuary of powdered glycyrrizae and aspirin, so the animal gets about ten grains of the latter to the dose.

The treated animals are then run into a yard, corral or shed in which plenty slaked lime and sulphur—one part of sulphur to ten parts of lime—is sprinkled on the ground, in dry weather, or on the floor of the shed in wet seasons.

Feed plenty of oats, with a good general tonic mixed in the salt as a lick.

In about a week take another look at the flock, and examine any still limping.

We have tried everything we have ever heard of for medicinal treatment. Copper sulphate in 10 to 20% solutions often gives good results. Concentrated arsenic solution has also worked in other outbreaks. In very large bands, of from two to five thousand head, the copper sulphate is probably the best, and may be repeated every week.

To relieve the soreness and extreme

The feet are soaked in "red oil"—gum camphor 2 oz.; sulphuric acid 1 oz.; turpentine 1 qt.; oil eucalyptus 1 oz., and q. s. red oil color.

lameness we like at least one application of the antiseptic oil, and in small outbreaks one can use an ointment made for the purpose.

This seems like a lot of bother to indulge in for simple foot-rot, but it will build up business for the practitioner, and that is what he is after.

Another thing, don't regard foot-rot as a trifling ailment, and assure the owner you will "have 'em well in a few days."

After reading these sadly penned words you may say to yourself: "That guy must have been through the mill."

We might add: "He has!"—E. T. B.

The Ash of Molasses

The ash of molasses is that part which is left after burning away the vegetable or organic part and consists of all of the mineral constituents. This ash is a very complex material, containing potassium, sodium, calcium, magnesium, iron, aluminum, copper, silicon, phosphorus, sulphur, chlorine, and carbon. The percentage of potassium is much larger than that of any of the other constituents. Chlorine is next in amount.

It has been found that the flesh of beets contains among other things organic as well as inorganic, potassium nitrate and potassium sulphate. The medicinal or physiological effect of these two salts is well known. If these two salts are in the flesh of beets, it is a reasonable presumption, both being soluble, that they are present in the juice from which the beet molasses is made. And, further, the fact that the element, potassium, is found in such a large quantity in the ash of both the beet and cane molasses is a further reason for presuming that these two salts are present in the molasses made from both beets and cane. Still further, the physiological action which these salts of potassium are known to have on the animal tallies so closely with the action which is sometimes observed from molasses, both beet and cane, that the opinion is all the more warranted that they are the cause of it.

The reason for the widely variable amount of ash in molasses and the consequent variation in the amount of these salts of potassium is easily understood when we think of the variety of soils in which the plants from which the molasses was made, grow. This variability is conclusively proved by the many analyses of molasses which are of record showing a wide divergence in the amount of ash found and, presumably again, consequently a wide divergence in the amount of potassium nitrate and potassium sulphate in the molasses. This is, I think, the reason why some molasses is so much more active than others in its cathartic and diuretic effect. And, finally, this variability is the reason why the percentage of ash should be shown in the definition and in the label, so that a feeder or manufacturer can guard against using any that might be dangerous. Molasses with a high ash and consequently potassium content can be used in manufacturing and the potassium saved, thus becoming an asset rather than a dangerous detriment.—*Bien. Rept. Kan. St. Bd. of Agri.*

A. E. LANGWORTHY.

Topeka, Kans.

From one-third to one-fifth of the feed of farm animals and poultry should be protein. Good feeding practice requires protein from three or more sources.

Rickets in Swine

By CHARLES E. SALSBERY,
Kansas City, Missouri

The Author

DIETARY disorders exact a heavy toll annually among young swine. Many of the affected animals die and many more suffer physical defects that make them economic failures and liabilities instead of assets on the farm.

Rickets is a very common dietary disorder of young swine. Deficient bone calcification characterizes this disease. It occurs during the growing period and, unless recognized and promptly corrected, progresses gradually, resulting in bone and joint malformations, unthriftiness and other defects which mean a serious financial loss to swine husbandry in direct proportion to the number of animals affected.

Cause

Typical cases of rickets may be produced experimentally by feeding unbalanced rations or by feeding perfectly balanced rations under conditions which do not facilitate proper assimilation and use of essential substances in the ration. Hygienic conditions may contribute materially to the development of rickets. The chief factors which insure adequate deposition of calcium in developing bones are rations containing the required amounts of calcium and vitamin D and plenty of sunshine for their proper utilization. The absence of any one of these factors constitutes an abnormal condition in the feeding of the young swine. If the deficiency is not corrected in time, rickets will develop.

Symptoms

A rather definite sequence of symptoms typifies each case of rickets. Apparent weakness, which soon is recognized as lameness, characterizes the onset of the disorder. Often, slight lameness may constitute the chief clinical indication of rickets in the early stages. Involvement of the front legs reveals a type of lameness known as supporting leg lameness which progresses with the disease and becomes more severe as the disease advances. The gait is stiff, jerky and stilty and any attempt to run produces stumbling or a tumbling movement, in which the pig falls on its face. When standing, the fore legs are drawn backward with the feet considerably back of the normal position. The changes that affect the contour of the lower part of the leg, elevate the heel, and the pig stands on the tips of the toes. Examination in the early stages of the development does not disclose any important changes of structure and does not produce pain.

Later, with more extensive involvement, no voluntary effort is made to stand on the feet. Supporting the weight of the body, by placing the knees on the ground, is a rather common position assumed and even the act of walking is accomplished in this manner. Standing or walking on the feet is very painful and the knee position, apparently, gives much relief. The tendency is to remain recumbent as much as possible.

Often, the posterior limbs become involved. When this occurs a different type of lameness is observed. In addition to the supporting lameness a swaying movement is seen. In walking, each step made by the pig is short and quick—a sort of "military stride". When standing, the feet are drawn forward; frequently, support is obtained by placing the weight upon the surface of the leg between the hock joint and the heel. Movement is accomplished by dragging the hind quarters, using the front feet as a fulcrum. In other cases a "side-saddle" position is assumed where the weight is supported on one side of the rear quarters with the feet extended to the opposite side.

Thickening of the joints of all limbs is

not uncommon. Fractures of the long leg-bones or ribs may be observed in some cases. Muscular atrophy is a common sign; the muscles of the shoulders and thighs are most commonly involved.

Pathology

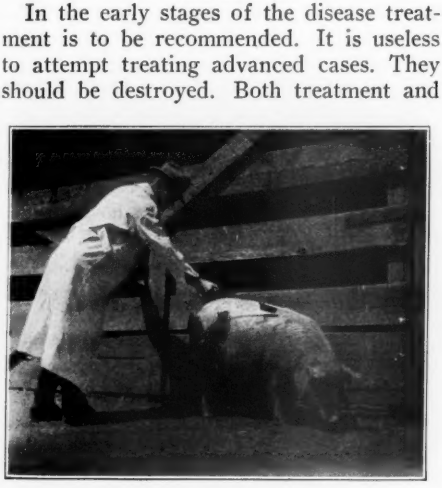
The changes observed at autopsy involve mainly the bones and joints. Alterations in structure and conformation of the long leg bones and ribs are quite constant. However, these changes do not always coincide with the extent of the clinical manifestations. The bones may be enlarged and of a soft or spongy consistency. Hemorrhages near the ends of the shafts of the long bones are commonly noted. The ends of these bones may be thickened and club-shaped.

The joints commonly show striking changes. The articular cartilages are furrowed and rough. Areas of erosion are frequently seen and in some cases the erosions may be so deep as to expose the bone itself. The ends of the affected bones are quite easily cut with a knife. Another test is to attempt breaking one of the ribs. A normal rib breaks with a sharp crack while a rib deficient in mineral bends and breaks like a piece of cardboard.

Treatment

In the early stages of the disease treatment is to be recommended. It is useless to attempt treating advanced cases. They should be destroyed. Both treatment and prevention are simple. A diet which contains the necessary amount of calcium and vitamin D and an abundance of sunshine are the chief requisites required.

Successful swine husbandry depends upon observing sound feeding practices which when followed will control dietary disorders of which rickets is a dreaded one. It is a preventable condition.



One stroke of the instrument applies the tattoo mark. Extensive tests have shown that the tattooing is successful regardless of age, size or color of the hogs.

Meningo-Encephalomyelitis

An epizootic[40] was encountered in several swine herds. The symptoms were: Lack of appetite, drowsiness, nervous disorders (epileptoid seizures, ataxia, excitement). The disease runs an acute course. From 80 to 90% of the cases terminate fatally. Necropsy reveals anemia, swelling of lymph-nodes, catarrhal bronchopneumonia, gastro-intestinal catarrh, and parasitism. Sometimes the autopsy yielded no findings. On histological examination of the organs, changes were found only in the central nervous system. The lesions represented a meningo-encephalomyelitis; they could not be distinguished from those encountered in hog cholera. Any other lesions usually encountered were merely accidental findings, and in no way connected with the affection of the central nervous system. It is assumed that the etiological factor is a virus, closely related to the virus of Aujetzky's disease.

Removal of Sarcoma

A growth attached to the posterior half of the hard palate completely occluded the fauces.[38] Anesthesia of the operative area was obtained by infiltrating the base of the growth with a 1% solution of procaine. A snare for the removal of the growth was made by using the canula of a Case's cervical forceps and passing a loop of obstetrical steel wire through it. With the aid of a pair of uterine dressing forceps, the loop was placed around the attachment of the tumor. It was pinched off by exerting traction on the wire and, at the same time, holding the canule firm against the attachment of the tumor.

[40] Bendinger, G. 1936. Zur Pathologie der Ferkelenzephaliden. *Arch. Tierheilk.* 70:426-438.
[38] Danks, G. 1936. Sarcoma in a sow. *Cornell Vet.* 26:75.

Vesicular Exanthema

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VESICULAR Exanthema is an acute febrile disease of swine characterized by multiple vesiculation tending to become confluent. There is also a tendency to sloughing and ulceration of irregular areas of the snout, lips, oral and nasal mucosa, of the coronary region, and of the udders of nursing sows. In severe outbreaks of the disease the morbidity is high; anorexia may be partial or complete; oral and nasal lesions are extensive, and hoofs may be sloughed. In less severe outbreaks only a small percentage of the herd may be visibly affected and these but slightly. After a few days' course of a mild outbreak it often requires the most careful observation by trained and experienced men to detect visibly affected individuals. The course of the disease is usually short, healing progresses rapidly, leaving rather characteristic depigmented scars in visible mucous membranes. Generally speaking the disturbance of the herd and the loss of flesh are both slight. Mortality, regardless of the severity of the symptoms or extent of lesions, is practically nil.

Because of the great similarity of the lesions exhibited by swine affected with vesicular exanthema and by the same species affected with foot-and-mouth disease the immediate sense of alarm felt when the foregoing lesions are first observed is readily appreciated. Coupling the observation of these lesions with the knowledge of the fact that on the very same premises true foot-and-mouth disease had been present a few years past gives one the very essence, the suspense, the uncertainty, the drama of our profession.

All live stock men fear foot-and-mouth disease, and rightfully so. The possibility that it may again gain entrance to our land is ever present. Veterinarians are constantly on guard as they should be lest this scourge slip past our barriers once more to wreak havoc among our herds. It is essential that special care and thought be given this matter along our borders. Ports of entry engaging in world-wide commerce are potential danger zones.

Small wonder then, the immediate concern felt by responsible veterinary regulatory officials when, as from nowhere, a disease amongst hogs clinically indistinguishable from foot-and-mouth disease made its appearance in Los Angeles County. Smaller wonder that these same officials hurried the affected herds including all test animals under ground in the shortest possible time. But there were differences between this 1932 trouble and previous outbreaks that were unquestionably foot-and-mouth disease. No cattle became affected. Test animals, so far as the tests were carried, did not react "according to Hoyle." Was this a new malady?

THIS disease was first definitely established as an entity and named by Dr. J. Traum, in 1933, after a careful study of an outbreak in San Diego County. It is probable that the similar outbreak which occurred in 1932 was the same disease. In the earlier outbreak, however, the affected animals were destroyed before tests had definitely differentiated it from foot-and-mouth disease or vesicular stomatitis.

As far as is known this condition is confined to California. It has not been reported elsewhere. To assert that this is a new disease, however, and that its California appearance was its first, in many respects places one in an untenable position. One then may readily ask why, if not a new disease, has it not been previously reported? To this logical question the following very plausible explanation has been offered. In countries where foot-and-mouth disease is and has been endemic for years vesicular exanthema may have existed side by side or as a concurrent infection. Since a certain degree of immunity, transient and

variable, is conferred upon animals recovering from an attack of foot-and-mouth disease it is conceivable that an outbreak of vesicular exanthema affecting of course only hogs might readily be looked upon as a form, type, or strain of foot-and-mouth disease which did not happen to attack the cattle, sheep, and other animals susceptible to foot-and-mouth disease at that particular time because of their supposed immunity. Where animals affected with and exhibiting the typical lesions of foot-and-mouth disease are a common, almost constant sight, vesicular exanthema might exist unsuspected.

Vesicular exanthema is a disease peculiar to hogs on natural exposure but may be transmitted to horses experimentally. In the latter the lesions are very slight and may readily escape notice; the systemic reaction, if any, is also slight and is confined almost wholly to a slight rise in temperature. All natural outbreaks to date have been confined to garbage-fed hogs.

THE cause of this disease has been definitely demonstrated to be a filter passing virus. It has been definitely differentiated from foot-and-mouth disease and vesicular stomatitis by Dr. J. Traum. His findings have been corroborated by veterinary research workers of the United States Bureau of Animal Industry and also in Germany.

The few cross immunity tests thus far conducted for the purpose of establishing a correlation, if present, between vesicular exanthema and vesicular stomatitis have given somewhat contradictory results. According to our information similar tests have shown no correlation between foot-and-mouth disease and vesicular exanthema.

THE general picture of hogs affected with this disease is that of foot-and-mouth disease. Temperatures vary from slightly above normal to 107° or 108° F. depending greatly upon the severity of infection and also the time the temperatures are taken during the course of the disease. Quickly following the rupture of the vesicles, the temperature drops. Vesicles may form upon the snout, lips, tongue, oral and nasal mucosa, interdigital region, coronary band, pad of the foot, and on the udders of nursing sows. Lesions may be present in any combination of the foregoing locations. Such vesicles are very sensitive to pressure, hence affected areas are greatly favored by the affected animal. When the vesicles on the feet of light hogs rupture, sensitiveness is so diminished that lameness is slight or absent. The erosions caused by rupture of the vesicles heal rapidly and rarely is there any secondary infection noted. Many mild cases may go unobserved if vesicular eruptions are slight and confined to the mouth. Appetite generally persists but in some instances the mouth and nose may become so sensitive that the mastication of ordinary feed is somewhat difficult. Lesions of the nasal mucosa may interfere with respiration. Rather frequently the nasal mucous membrane becomes severely congested probably with some vesicle formation and later becomes partially detached from the submucosa but remains attached farther up in the nasal cavity. The passage of air then causes a fluttering of the loose mucosa and interferes with respiration to a variable extent.

Differential Diagnosis. — Differentiating vesicular exanthema from either foot-and-mouth disease or vesicular stomatitis cannot be done by clinical examination of affected animals. One must resort to the inoculation of suitable test animals. Those commonly used for this purpose are swine, cattle, horses and guinea pigs. The material used for inoculations is derived from the lesions, that is, either the fluid contained in the vesicles or the vesicular coverings or both are used. This material is triturated in a suitable buffer solution for preservation, storage, and transportation. Inoculations are made either intradermally, using the tunneling or puncturing methods, or by scarification of mucous membranes of the tongue, lips, muzzle, and snout, or by intravenous or intramuscular injections. These methods may be used alone or in any desired combination dependent upon just what the operator has in mind. Such tests should be conducted only by the rep-

resentatives of governmental agencies who are responsible for diagnosing questionable foot-and-mouth disease outbreaks.

The following tabulation shows the reactions to virus injections in the presence or absence of lesions in the different species of test animals used, and thereby is established the diagnosis under field conditions:

Test Animals	*Vesicular Exanthema*	*Vesicular Stomatitis*	*Foot-and Mouth Disease*
Swine	Positive	Positive	Positive
Horses	Positive	Positive	Negative
Cattle	Negative	Positive	Positive
Guinea Pigs	Negative	Positive	Positive

In the control of outbreaks of this nature it is essential to establish a definite diagnosis as quickly as is possible. In the meantime because of the similarity of the symptom syndrome with that presented by foot-and-mouth disease it is necessary to quarantine and guard affected premises in the manner used in the control of the latter. When a diagnosis of vesicular exanthema is made the premises and affected herds are kept under quarantine only for a period of 30 days after lesions are evident.

IT MAY be of interest to note that on one of the larger ranches in Southern California, which experienced an outbreak in 1934, when feeder pigs were introduced seven months later a few mild cases developed among these pigs. No cases of natural infection were observed among the hogs which had been on the premises for some time. This latter outbreak would seem to imply that the virus was maintained in some latent form on the premises or perhaps by carriers among the previously infected swine. Pigs which had been used in the previous outbreak seven months earlier as test animals were still on the place and were inoculated with material from affected animals in the latter outbreak to determine their immunity, if any. In every case these hogs contracted active though mild cases of vesicular exanthema, and exhibited typical lesions. One deviation from the usual symptoms was noted however in that the temperatures of the reinoculated swine remained several degrees above normal for a number of days after the vesicles had broken. In this case there was apparently slight immunity from the previous attack, certainly not sufficient to protect against artificial inoculation.

THE foregoing description should not be interpreted to mean that the true position of vesicular exanthema in the galaxy of infectious diseases is definitely established or well understood. Quite the contrary is the case. Many are the important questions the answers to which lie shrouded in mystery. Whence came this heretofore unheard of malady to strike repeatedly, but with blows varying greatly in intensity, at California, garbage-fed hogs? Why just California hogs? And why only garbage-fed hogs? Where does this marauder lurk in the months between outbreaks? Is the virus the same in all outbreaks? What are the contributing influences, if any, that cause one outbreak to be of so mild a nature as to almost escape notice while another is of such severity that hoofs may be shed and extensive sloughs occur in the snout, mouth, tongue, lips, foot, and udder regions? Are recovered animals carriers? How may we differentiate this infection from the catastrophic foot-and-mouth disease without resort to the cumbersome and time-consuming animal inoculation trials? The problems of the entire field of virus diseases with its innumerable unknowns confront the investigator working with this disease. In every new outbreak he is never certain but that in this case it may be the dread foot-and-mouth disease itself.

WE HAVE drawn freely from our own observations and experience with this disease, also from the following references: Report of Committee on Miscellaneous Transmissible Diseases, *Jr. of A.V.M.A.*, N.S. Vol. No 39, pp 364-367, and Vesicular Exanthema of Swine appearing in the Proceedings of the 39th Annual Meeting of the United States Live Stock Sanitary Association, pp 316-334., by J. Traum and L. M. Hurt; also The Eleventh Annual Report of the Los Angeles County Live Stock Department.

Nematodes and Nematodiasis in Swine

THE problem of roundworms in swine is of greater economic importance to the practitioner than appears on the surface. Roundworms are not only an ever-present hazard to their host, but afford the most plausible excuse for fraud upon the swine raiser by the legion of nostrum peddlers employed by unscrupulous hog remedy firms. These suave vermifuge venders, in the guise of expert health advisers, perform if necessary, a post-mortem examination which, naturally, yields them the needed support to their sales talk in the form of a worm, and the credulous hog breeder is induced to purchase a questionable concoction at an extortionate price, regardless of its application to the existing condition. Aside from constituting a staggering drain on the pocket book of the farmer, these quacks inflict an enormous damage to the swine herds they "service," in certain instances, because of a harmful effect of their remedies, but more often because, relying upon them, the farmer delays or entirely neglects the proper treatment of his herd. Because of the activities of these worm-medicine peddlers, it is exceedingly important that every veterinarian be constantly alert in the matter of combating all parasites in swine.

Hogs, by reason of their rooting and scavenger habits, always harbor some intestinal parasites. It is conceded that so long as the host is in "equilibrium" with his parasites, the latter may be considered more or less as commensals, causing little or no damage. However, this does not apply to hogs kept under conditions of intensive rearing, or in an insanitary environment, or improperly fed, or exposed to any of the more serious infections of swine. Disaster merely waits the combination of parasitisms and any of these other unfavorable factors. The concentration of pigs in fenced-in hog lots or pastures during spring, summer, and autumn, aggravated often by adverse climatic factors or unfavorable topography and type of soil; the concentration of pigs in hog pens, when stabling them for winter protection; the unnatural intensive feeding with concentrates; an improper balance of minerals, or a lack of vitamins, or of other essential food constituents in the daily ration, constitute grave disturbances of important biologic factors. The alteration of any one of these factors will disarrange the entire ecologic relation of parasite and host and quickly lead to massive worm infestation with its dire consequences.

The host-parasite relationship between the pig and his roundworms is not rigid and unchangeable, but as unstable as the political situation in Europe. The "peaceful compromise" on the part of the parasite is merely a defiant state of war, with the odds against the host in the ensuing battle for survival, in spite of the obvious fact that it is not to the advantage of the parasite to kill its source of food and thus hasten its own destruction.

To be able to check intelligently the insidious but constant loss to animal industry from the ravages of nemathelminth parasites, the veterinarian must have a fair understanding of the parasites he is dealing with. Although a specific diagnosis of most parasitic diseases can be made only by the identification of the causal agent, this is not too great a problem. The gross characteristics of the parasite, the organ invaded, and the microscopic examination of the eggs, are, usually, sufficient for a generic diagnosis.

The following survey includes the more important nemathelminthic diseases of swine grouped for discussion according to the organs involved, with special emphasis on the clinical syndromes and related phenomena.

Parasitisms of the Digestive Tract

Gongylonema pulchrum is a filiform worm inhabiting the gullet. This roundworm is found imbedded in zig-zag fashion in the mucosa or submucosa of the tongue and esophagus. The male averages 23mm in length; the female about 37mm. The eggs possess a smooth surface and contain embryos when oviposited. Invasion takes place through ingestion of roaches and beetles which have eaten the eggs of these worms in consuming swine feces which constitute a part of their diet. The occurrence of this roundworm in swine is of importance in meat inspection only. The parasitism is termed gongylonemiasis.

Stomach Worms.—Swine in the United States harbor three species of roundworms in their stomachs. They belong to the genera Ascarops, Hyostrongylus, and Physocephalus and are described as follows:

1. *Ascarops strongylina* is a filiform, blood sucking, white worm. The male is 10 to 15mm, the female 16 to 22mm long. The eggs are thick-shelled, elliptical in shape, and slightly flattened at each pole. They contain a well developed embryo when deposited. Infestation occurs from the ingestion of certain beetles which have feasted upon feces containing the eggs of this stomach worm.

The symptoms produced by the presence of this worm are loss of appetite, thirst, and restlessness. The post-mortem lesions recorded are thick, lamellar pseudo-membranes, firmly adherent to the pyloric stomach; underneath this is a superficial loss of mucous membrane. Often, little nodules, terminating in ulcers, are found.

2. *Hyostrongylus rubidus* is a thread-like, reddish nematode occurring in the fundus portion of the stomach. The male is 5mm long, the female is 8 to 8.5mm long. The eggs are thin-shelled, transparent, and oval in shape, with poles usually unequal in convexity. Invasion is, probably, by ingestion of food or water, contaminated with infective larvae. The parasites burrow into the gastric mucosa and suck blood. This worm has been found, usually, in connection with an excess of thick gastric mucus, suggesting that it occasions a chronic catarrhal condition. When present in very large numbers it causes considerable injury. The gastric mucosa assumes a hemorrhagic appearance with heavy catarrhal exudate and slight ulceration in the gastric fold. At times yellow corrugated pseudo-membranes, leading to a croupous gastritis, are observed. In heavy infestation, especially when the resistance is lowered, the animals lose condition rapidly, become emaciated and weak, and show a tendency to lie down frequently. The appetite may vary, but the animals are usually thirsty.

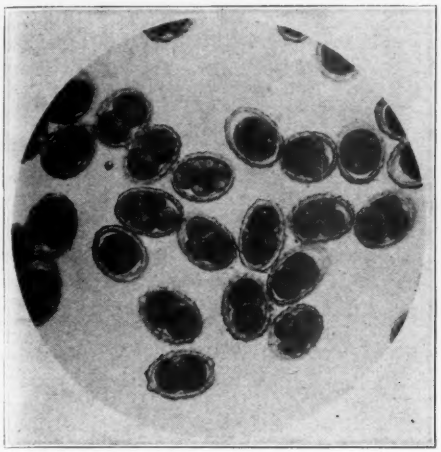
3. *Physocephalus sexalatus* is a slender worm inhabiting the stomach and the small intestine. The male is 6 to 9mm, the female 13 to 19mm long. The egg is elliptical, slightly flattened at the poles, and contains a well-developed embryo when laid. The shell is surrounded by a thin, irregular membrane. Invasion takes place by the ingestion of certain beetles which have swallowed these worm eggs. The injurious effects produced by this worm are very similar to those produced by the two stomach worms previously mentioned. All three stomach worms are capable of causing epizootics of a rather serious nature.

Ascariasis.—The ascarids are probably the most common intestinal parasites of swine in the United States and have been the subject of more investigation than other parasites of this animal. It was as a result of research into the life history, effect and control of this parasite that the "McLean County System" of raising hogs was developed. This method of swine husbandry provides for protecting pigs from filth from the time they are farrowed until they reach a weight of 40 to 70 pounds, and has proved highly successful not only in reducing losses from ascarid infestation, but from other internal parasites as well, and from most of the filth-borne diseases of swine, particularly the enterites and bull nose.

But one species of ascarid—lumbricoides—infests swine. The variety affecting pigs is very closely related to roundworm of children, and both varieties, that of children and pigs, are susceptible of intertransmissibility. However, neither variety

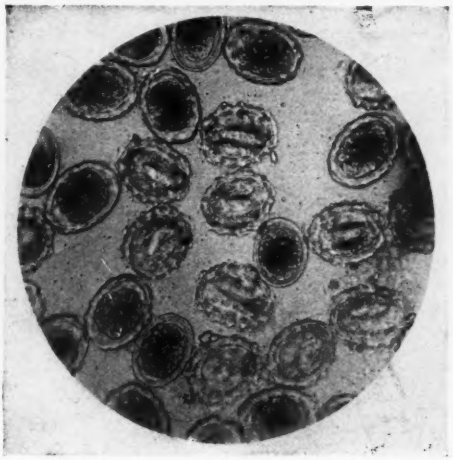
reaches sexual maturity in other than the natural host.

Ascaris lumbricoides var. *suis* is the large roundworm of swine. The males measure 15 to 17cm in length, and about 3 to 3.2mm in thickness. The females measure from 20 to 25cm in length, and 5 to 5.5 mm in thickness. The eggs are either rounded or elliptical. They possess a transparent shell, surrounded by a thick, albuminous coat. The latter is irregularly mamillated and usually stained yellow.

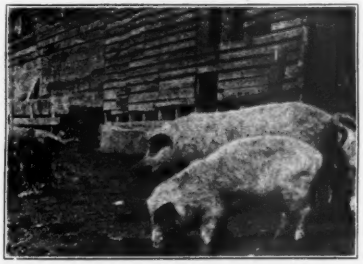


Ascaris eggs in the process of development showing cell division. The eggs are not infective until embryos develop within.

The invasion takes place by the swallowing of the infective worm eggs—after the embryo has molted—during rooting, feeding or suckling. The eggs hatch in the lower part of the small intestine and in the cecum. The first stage larvae migrate by way of the blood stream to the liver and then to the lungs, where they disperse in the capillaries. From there they travel to the alveoli, where they grow and molt. From about seven to 23 days after invasion, the larvae migrate up the trachea to the pharynx and pass down the esophagus to the intestine, where, in the course of 10 weeks, they become sexually mature and mate.



Ascaris eggs showing vermiform embryos within the egg-shell. In this stage the eggs are infective when swallowed by a suitable host.



Conditions Favoring Ascaris Infestation

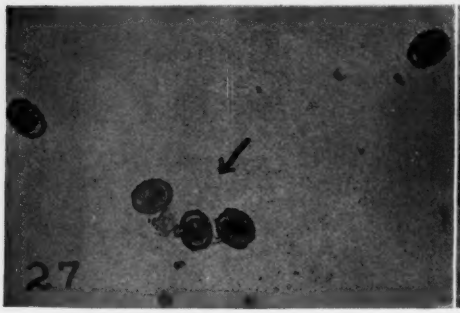
Young pigs which become heavily infested, suffer from thumps and may cough and show a nasal exudate, indicating pneumonia. They usually hide in dark corners, or creep under the straw, and die in about a week after the invasion. When the invasion is sublethal, the animals are "thumpy" for a considerable period, become anemic, stunted and pot-bellied. Perverted appetite, intermittent diarrhea, followed by constipation or tympanitis have also been observed. Nervous symptoms are occasionally seen in older animals. On postmortem examination petechial hemorrhages and varying degrees of bronchitis or pneumonia may be found. Cicatrices in the lungs persist throughout the life of the animal. In older animals the small intestine, the gall duct and gall bladders, and the pancreatic ducts are found filled with ascarids. The organs themselves exhibit inflammatory

processes, and often ulcers. Of the various kinds of parasites infesting the pig, this is undoubtedly the most injurious one. Pigs four months of age or older possess a high resistance to this parasite. Adult swine are little, if at all, harmed by exposure to even mass infestation.

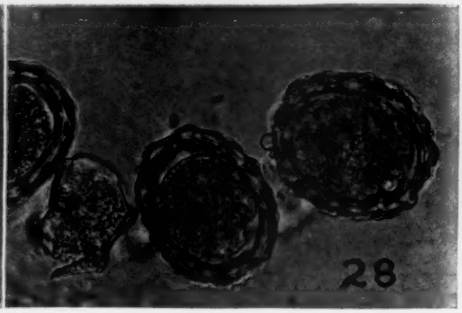
Hookworm Disease.—The hookworms of swine in the United States belong to two genera, Globocephalus and Necator. Hookworms of swine, like hookworms of man and of other animals, possess the ability to penetrate the unbroken skin. This, however, is probably not an important channel of infestation in swine.

The hookworms are not real blood suckers, but tissue feeders. They suck small portions of the mucous membrane into the mouth capsule and there digest the tissue, swallowing the cells. The cervical and esophageal glands of these worms contain anti-coagulants, and the blood often passes through their alimentary tract unaltered. Even after the detachment of the parasites, the escape of blood from the wound continues for some time. Naturally, this drain of blood is principally responsible for the grave symptoms of hookworm infestation.

Globocephalus urosubulatus inhabits the small intestine. The male is 4.4 to 4.58mm long; the female is 6.5 to 7.54mm long. It is assumed that invasion takes place both by way of the mouth and through the skin. In the intestine the worms attach themselves to the mucosa, causing punctiform hemorrhages in association with an intense catarrhal condition. The parasite, like other blood suckers, is capable of producing anemia.

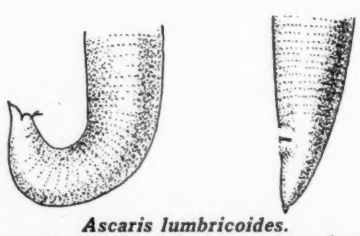


Eggs of Ascaris lumbricoides (or suum), the common roundworm of swine, x 100. The eggs are yellow.—Benbrook.



Eggs of Ascaris lumbricoides, x 400.—Benbrook.

Ascaris lumbricoides.
a, male; b, female. Four-ninths natural size. From Neveu-Lemaire.



Ascaris lumbricoides.
Left, male tail, lateral view, enlarged; right, female tail, lateral view, enlarged. From Neumann, after Leuckart.

Necator suillus is found in the ileum and jejunum. The male is 5.25 to 8.75mm long; the female measures 7.3 to 12.5mm in length. The eggs are segmenting when deposited. Invasion, probably, takes place by ingestion of infective larvae, or possibly

through the skin. The chief symptoms and lesions in pigs are muscular deficiency, a thickened intestinal mucosa, hemorrhagic wounds in the mucosa, and swelling of the abdomen.

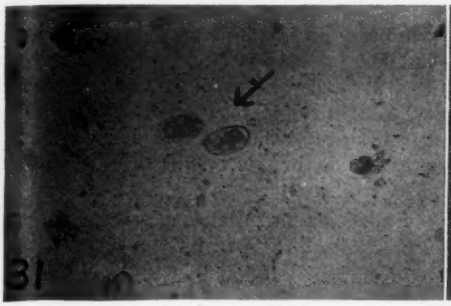
Strongyloidiasis. — The strongylidae is one of the most widely distributed families of internal parasites, one or more species infesting all domestic animals. It is also the most difficult of parasites to prevent, since the eggs and embryos, when no suitable host is available, survive for years under extremes of climatic and environmental conditions sufficient to destroy other forms of animal life.

Many of the species offer great obstacles to successful treatment by reason of their habitat in tissues quite inaccessible to medication.

Strongyloides ransomi inhabits the mucosa of the small intestine. The male measures 0.86 to 0.9mm in length, and has a rhabditiform shape. It is unable to penetrate tissues, and is usually free living. The female has a filariform shape, and measures 3.3 to 4.5mm in length. The eggs are ellipsoidal, thin-shelled, and contain an embryo at the time of oviposition. Invasion, presumably, takes place either by ingestion (Hall), or through the skin (Mönnig). European writers report that massive strongyloides infestation in pigs causes anemia, emaciation, enteritis, catarrhal conjunctivitis, and bronchial catarrh.

Oesophagostomiasis. — The oesophagostoma of swine are of economic, rather than biologic, importance, since in reasonable numbers they are not particularly harmful to the animal, but owing to their prevalence, a large percentage of the intestines of sheep and swine is rendered valueless for the manufacture of casings.

Four species of the oesophagostoma infest swine—dentatum, longicaudatum, brevicaudatum and georgianum. The dentatum has the widest distribution of any of the four and is more prevalent than the others in most localities.



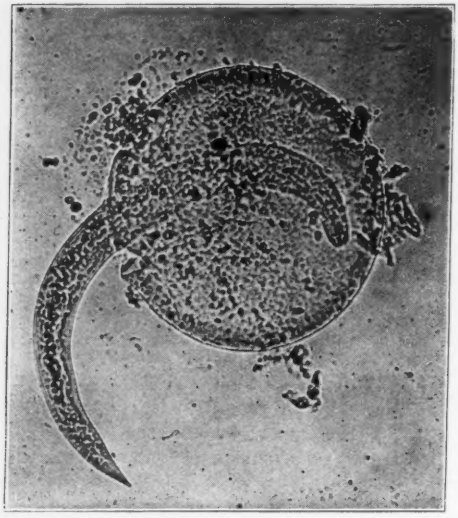
Eggs of Oesophagostomum dentatum, nodular worm of swine. x 100.—Benbrook.

Eggs of Oesophagostomum dentatum, x 400.—Benbrook.

Oesophagostomum dentatum is a small opaque nematode, appearing white or greyish-brown. It inhabits the large intestine. The larvae live in inconspicuous nodules in the wall of the intestine, while the adult worms live in the mucus. The males are 8 to 12mm long; the females measure 12 to 15mm in length. The eggs are thin-shelled, transparent, and usually elliptical. Invasion is acquired by swallowing the infective eggs. After hatching, the larvae penetrate to the intestinal wall and form small intestinal nodules. Later, the larvae return from the nodules to the lumen of the intestinal tract where they grow to maturity. Some of the nodules may ulcerate. Heavy infestation may cause unthriftiness, intestinal irritation, weakness, anemia, constipation alternating with diarrhea, and possibly death. The chief economic importance of the parasites is that the intestines, containing nodules, are inferior or useless as sausage casings. "Chitterlings," showing inflamed or ulcerated nodules are esthetically

and otherwise objectionable as articles of food and are condemned under federal meat inspection procedure.

According to investigations, carried out by L. A. Spindler, the daily administration of iron copper solution to pigs harboring nodular worms, seems to counteract the ill effects of these worms.



Photomicrograph of a Cyst Obtained from the Wall of Large Intestine of a Pig. Note Larva of Oesophagostomum Species Partly Extruded from Cyst.

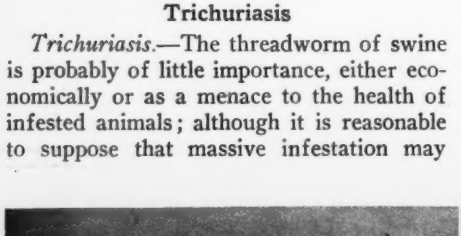
Trichuriasis

Trichuriasis.—The threadworm of swine is probably of little importance, either economically or as a menace to the health of infested animals; although it is reasonable to suppose that massive infestation may cause intestinal inflammation and diminished function, with its consequent economic loss and lowered resistance to other parasitisms and to certain infectious diseases.

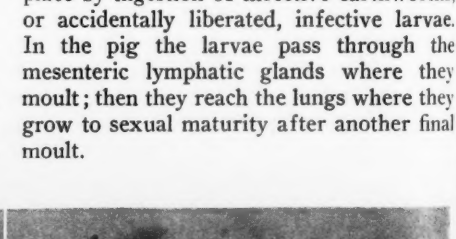
Trichuris suis is a slender thread-like parasite, which inhabits the cecum and colon; being firmly embedded in the mucosa with the anterior portion of its body. The male is 33 to 40mm long; the female measures 34 to 50mm in length. The eggs are lemon-shaped, thick, and dark brown in color. No symptoms are noted in moderate infestations. Climatic and soil conditions are said to be factors in the distribution of this parasite.

Parasitisms of the Respiratory Tract. Lungworm Disease

Verminous bronchitis and pneumonia may be caused by various migrating larvae, such as: the first stage larvae of Ascaris; the third stage larvae of Stephanurus; and the third stage larvae of Necator. The nematode, however, which makes the respiratory tract its permanent abode is *Metastrongylus elongatus,* a slender, white or brownish worm. The male is 11 to 25mm long; the female measures 20 to 25mm in length. The eggs have a corrugated surface. The outer shell is thick, and elliptical in shape. The embryo is well developed when the egg is deposited. Invasion takes place by ingestion of infective earthworms, or accidentally liberated, infective larvae. In the pig the larvae pass through the mesenteric lymphatic glands where they moult; then they reach the lungs where they grow to sexual maturity after another final moult.



Egg of Trichuris suis, whipworm of swine. x 100.—Yellow brown color.—Benbrook.



Egg of Trichuris suis, x 400. Note the lemon-shaped outline.—Benbrook.

The irritation caused by the invasion of this parasite, and the continual responsive production of mucus produces a thickening and enlargening of the bronchial walls. Verminous bronchitis is characterized usually by a cough. From the bronchi the inflammation spreads to the alveoli with the formation of a chronic, catarrhal, lobar pneumonia. Invasion, as a rule, is not fatal, but may kill young animals.

Other Metastrongylidae reported from the respiratory system of American swine are *Metastrongylus salmi* and *Choerostrongylus pudendotectus.*

Parasitisms of the Urinary Tract
Kidneyworm Disease

Stephanurus dentatus (the kidney worm) is a thick, mottled worm, inhabiting the perirenal fat, the pelvis of the kidney, and the walls of the ureters. The male measures 20 to 30mm in length; the female is 25 to 45mm long, and about 2mm wide. The eggs are thin-shelled and segmenting when deposited. Invasion takes place either through ingestion of infective larvae, or by penetration of the larvae through the skin. Percutaneous infection causes the formation of nodules in the skin, subcutaneous edema, and enlargement of the superficial lymphglands. These lesions disappear after three or four weeks. The migrating larvae produce lesions of an acute inflammatory nature. The inflammatory processes may take the form of abscesses or give rise to cirrhosis and multiple adhesions of organs. The migration to the urinary system is completed in about four to six months after invasion. Moderate infestation does not produce recognizable symptoms. Heavy infestation produces loss of appetite, general unthriftiness, stunted growth, emaciation, and sometimes complete paraplegia. The parasite causes a certain amount of destruction of liver tissue. On leaving the latter organ the larvae enter the perirenal tissue from the abdominal cavity, causing cysts and hypertrophy of the tissues. The cysts vary in size from 5 to 40mm in diameter. Each cyst usually contains a single pair of worms embedded in a greenish yellowish pus. These cysts usually communicate with the ureters by fistulous tracts. In massive infestation the entire kidney region becomes involved. The fat around the upper part of the ureters is usually much thickened. The ureter itself is often thickened and may

Stephanurus dentatus
Left: Egg containing embryo; enlarged. From Taylor.

Gongylonema pulchrum.
Right: Entire worm, natural size. From Molin.

have its lumen occluded. Chronic cystitis is common. The kidneys may also be invaded and cysts formed. Thrombi in the hepatic blood vessels are common. Ascites is often present. The eggs are voided in the urine.

In passing, mention should be made here of the giant kidney worm, *Dioctophyme renalis,* inhabiting the pelvis of the kidneys and the urinary bladder, but of exceedingly rare occurrence in swine.

Parasitisms of the Locomotory System.

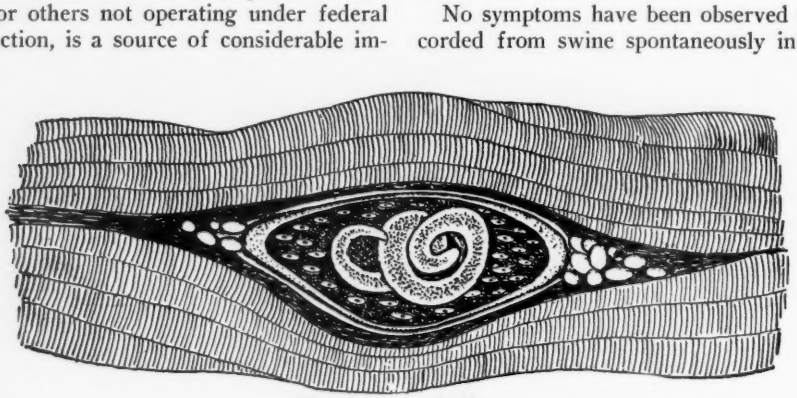
Trichinosis.—Trichinosis of swine is of great importance, because of its transmissibility to men, and since no inspection of meat that will unfailingly detect its presence is practical. Refrigerating meat products for a considerable period offers complete protection, but only at considerable financial cost. It is not practiced except in meat-packing establishments operating under federal inspection. As a result, the incidence of trichinosis in man is high, probably averaging 14% over the whole of the United States and reaching 20% in the eastern third of the country. It is a safe estimate that a million cases of acute trichinosis occur in persons in the United States annually, although but a small percentage are correctly diagnosed.

Trichinosis in swine occurs only in animals that feed upon uncooked garbage or eat the carcasses of infected rodents. The means of prevention and virtual eradication are obvious. Trichinosis in man occurs only in those who eat the meat of infested swine raw, or but partially cooked. "Hot

dogs" are thought to be the principal source of infestation of persons in this country; although pork sausage made from animals killed on the farm, by local butchers, or others not operating under federal inspection, is a source of considerable importance, and possibly the greatest source, of the disease in man.

Trichinella spiralis is a minute worm, nearly microscopic in size. The male is 1.4 to 1.5mm long; the female 3 to 4mm long. Swine become infested by eating offal of infested swine or carcasses of trichinous rats or other rodents. Sexual maturity is attained in the upper part of the small intestine, within a few days after ingestion of the larvae. After mating, the female burrows deeply into the mucosa and produces living embryos for a period of several weeks. These invade the lymph spaces and ultimately the bloodstream, and finally become encysted in the muscles, in greatest numbers in the diaphragm. Infestation occurs only when these encysted larvae are ingested by a suitable host, hog, human or rodent.

No symptoms have been observed or recorded from swine spontaneously infested with trichina. In artificially infested swine, an intestinal catarrh appears three days after infection. Other symptoms are a diminished appetite, slight dejection, vomitus and diarrhea lasting about one to two weeks. At the termination of the second week, the infested pigs exhibit itching, a stiff gait, superficial and accelerated respiration, difficulty in mastication and swallowing, a hoarse grunt, edema of the eyelids and edema of the legs. After four to six weeks all symptoms may disappear completely. In fatal cases, which appears to occur in swine only under experimental conditions, the exitus is preceded by severe anemia and cachexia.



Trichinella spiralis.
Larva encysted in muscle. Enlarged, From Ransom, after Leuckart.

Trichinella spiralis.
Above, female, enlarged; below, male, enlarged. From Leuckart.

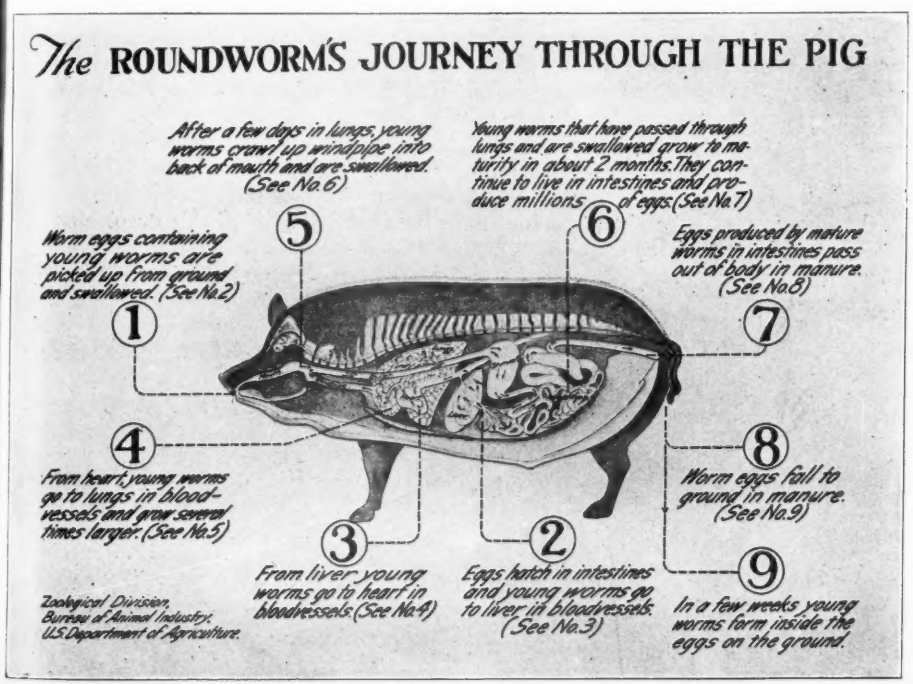
Anthelmintic Treatment

The prevention of the infestation of our domestic animals with their respective internal parasites is, with few exceptions, impractical or, under conditions of live stock husbandry, impossible. The fact that our domestic animals habitually defecate upon their dining table, limits the effectiveness of such sanitary measures as can be instituted. It is indeed fortunate for our animal industry and for veterinarians who serve it, that our domestic animals and their parasites have lived together for eons of time and the former have survived. Naturally the host species must survive if the parasite species is to survive. In other words, throughout the period of evolution when a parasite developed characteristics destructive to the survival of the host, it too, in turn, succumbed. Only those parasites and hosts remain that are capable of living together under conditions reasonably favorable to both.

The usual methods recommended for the prevention of parasitic infestation consist essentially in interrupting the life cycle of the parasite, and naturally, measures are directed against the weakest link in that chain.

It should not be forgotten, however, that domestic animal hosts possess a very considerable resistance to their parasites, and ordinarily, raising the resistance of the host by improved nutrition and hygiene, goes a long way toward lessening the harmfulness of parasitic infestation. A further measure of prevention is lessening the amount of infestation, reducing the number of parasites that may invade a given host. This, together with improved nutrition and hygiene and lessened drain upon the vitality by overwork, or excessive production of milk or eggs, etc., is usually successful in parasitic control; unless the animal be already infested by a number of parasites greater than it can tolerate and, at the same time, build up its resistance.

Where this latter condition prevails, treatment of the animal for the destruction


The ROUNDWORM'S JOURNEY THROUGH THE PIG
After a few days in lungs, young worms crawl up windpipe into back of mouth and are swallowed. (See No. 6)
Young worms that have passed through lungs and are swallowed grow to maturity in about 2 months. They continue to live in intestines and produce millions of eggs. (See No. 7)
Worm eggs containing young worms are picked up from ground and swallowed. (See No. 2)
Eggs produced by mature worms in intestines pass out of body in manure. (See No. 8)
From heart, young worms go to lungs in blood-vessels and grow several times larger. (See No. 5)
Worm eggs fall to ground in manure. (See No. 9)
From liver, young worms go to heart in bloodvessels. (See No. 4)
Eggs hatch in intestines and young worms go to liver in bloodvessels. (See No. 3)
In a few weeks young worms form inside the eggs on the ground.
Zoological Division, Bureau of Animal Industry, U.S. Department of Agriculture.

of all, or a major portion of its parasites, is the only helpful resort.

Living in the host as parasites do, protected by its tissues, treatment of the parasitism consists essentially in the administration of a poison destructive to the parasite, but not, at the same time, fatal or severely incapacitating to the host. There are few such poisons. The ones of choice for the treatment of parasitisms of swine are oil of chenopodium, tetrachlorethylene, carbon tetrachloride, carbon disulphide, hexylresorcinol and santonin. The fact should not be lost sight of that of the foregoing the first four are active poisons to the host as well as to the parasite, and they should be handled and administered, subject to the usual safeguards observed in the use of poisons.

Since the desideratum is to poison intestinal worms by contact with or ingestion of the poison; and not, at the same time, too severely injure the host, it is obvious that minimal doses of the poisons destructive to the parasite should be used, and it is likewise obvious that the smaller the amount of ingesta present when the poison is administered, the greater the proportion of the poison in the intestinal tract the parasite must ingest or with which it must come in contact. Thus fasting the animal to lessen the intestinal content becomes a prerequisite for anthelmintic treatment when the active poisons (one-dose treatment) are used. The fast may be short, as for the treatment of stomach worms, or much longer when parasites far down in the intestinal tract are to be reached; but in any case, if the animal is not fasted and is treated with the intestinal tract full of ingesta, parasites will escape the maximum poisonous effect of the medication.

Either improved sanitation, better hygiene, or a more adequate ration, and usually all three, should be an invariable follow up of all anthelmintic treatment. Unless the animal's resistance to the parasite can be importantly raised, or the amount of infestation at its source can be largely reduced, the infective stages of most intestinal parasites of animals are so nearly ubiquitious as to speedily reinstate the same condition for the relief of which the animal was treated. Preventing immediate reinfestation is as much the responsibility of the practitioner as is the initial anthelmintic treatment. To neglect it is to adopt one of the serious faults of the medicine peddler. The old teaching that parasites cause unthriftiness satisfies only the parasitologist; the clinician knows that nine times out of ten, unthriftiness is the cause of parasitisms and despairing of preventing infestation or reinfestation fortifies the host by good care and adequate feeding.

Chenopodium.—This drug is considered almost 100% efficient against ascarids, and ranks next to carbon tetrachloride against hookworms. The dose for 100 pounds of swine is one fluid dram (4cc). It may be administered either in capsules or dissolved in castor oil. It is contra-indicated in febrile conditions and in weak and debilitated animals. It must be accompanied or followed by a cathartic which should be repeated if evacuations do not occur within one hour.

Carbon Tetrachloride.—This drug was introduced by Hall as a remedy for hookworms. The dose for pigs is one to two drams per hundred pounds live weight. Carbon tetrachloride causes a severe degenerative process in the liver and should not be repeated within a period of less than a month. Animals on a calcium deficient ration are inclined to sudden death following the administration of this drug.

Carbon Disulphide.—Bozicevich and Wright recommend this drug for the removal of stomach worms from swine. The minimum dose for 100 pounds of swine is 4.5cc. The drug is to be given either by stomach tube or in capsules. The efficacy varies between 85% and 96%, depending on the parasite species to be removed.

Hexylresorcinol.—This drug is recommended by Schwartz for the removal of nodular worms. Doses of four grams to 50-pound pigs proved 70% efficacious in experiments which he carried out.

Santonin.—This agent bears a poor repute with parasitologists who have subjected it to critical tests for the removal of roundworms in swine and other animals,

that is, where animals known to be infested have been treated with santonin and later destroyed and the living ascarids harbored in the intestinal tract counted. However, among clinicians it has a reputation much older than the oldest parasitologist. Further, it should be remembered, as indicated above, it is not necessary to destroy every parasite in an animal to relieve it from the effect of a parasitism. A destruction of the major portion of the parasites, probably not more than 75%, will be just as successful clinically as the removal of 100% of the invaders.

Santonin possesses the advantage of being relatively harmless to swine, and therefore, is suitable for adding to the feed. It may thus be given over a long period. If it possesses in some measure the capacity to render the intestinal content unsuitable for the development and reproduction of ascarids, together with good feed and good hygiene, relief from the parasitism can be attained. It is probable that it does possess this attribute. It could scarcely have maintained a reputation as a parasiticide extending into antiquity without possessing at least this merit. Of course, it is open to the objection of expense. Given over a period sufficiently long to effect a marked reduction in the number of ascarids in swine, the cost is considerable.

Dose.—Milks recommends the following prescription per 100 pounds live weight:

Santonin	8 grains
Calomel	5 grains

Sig. Give b.i.d. mixed well in feed; skip a few days and repeat.

Clinical experience indicates that the foregoing medication should be given for seven to 10 consecutive days and after a short intermission, repeated for an equal period, and even for a third 10-day period if the owner of the animals can afford the expense.

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Umbilical Cysts

Umbilical cysts fall into the following classification:[86]

1. Either a large cyst, or a conglomerate of isolated individual cysts is found, located within the umbilical ring. They do not exhibit any protrusion, depression or rupture formation.

2. Outside the umbilical ring occur, either small or large, roundish elevations of a rupture-like character. The cysts are situated either at the inside of a cave-formation, or upon the umbilical ring. In the latter case they form usually a single row, rarely a double row. These cyst collections either form a conglomeration, or polyp-like, branched, massive tumors. Each of the latter terminates in a taut cyst containing a clear fluid. When these conglomerate cysts or the polypi are located upon the inner surface of the cavity, the groups are rarely uniformly distributed, but usually dispersed over the entire surface.

3. A combination exists of cysts and rupture, separated from each other by the umbilical ring. These double formations have the shape of an hour-glass.

Differentiation of Origin of Ham

In boars and barrows,[80] depending on the state of fattening, a more or less firm membrane stretches from the fat cushion over the adductor muscle. In female pigs the adductor is outlined distinctly in the surrounding fat tissue. This differentiation is quite important for the reason that hams originating from barrows are preferred in the trade to those from sows. Previously, the loss of tissue substance necessitated by the removal of the penis and navel sac was the only guiding mark for identification.

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Drugs Used in Veterinary Medicine

XII. MEDICINAL DYES

By VICTOR LEWITUS, New York City

Historical Sketch

The first steps in the development of dye therapy are difficult indeed to trace, but we do know that man must have used the colored drugs early in his struggle for existence. The first dyestuff to be used by ancient peoples appears to have been indigo. They put it to use as a cure for ulcerated areas. The first synthetic dye, discovered in 1771, was picric acid, which, even though it was early shown to be highly toxic, still found numerous useful applications in medicine. The work of Ehrlich during the years 1885 to 1891 wrote into this field of therapy a new chapter. He showed that certain dyes have an affinity for certain tissues. He also made the startling observation that dyes can affect bacteria unfavorably without injuring the tissues. On this basis (in 1891) both Ehrlich and Guttman treated malaria successfully with methylene blue. Similar work was done by Stilling in experiments with wound disinfectants; and later Shiga and Ehrlich (1904) published results of their work with benzidinazo dyes as treponemicides. Since the production of the simpler acridine compounds by Bender in 1889, drugs such as trypaflavine (improved by Benda, Browning, and Shiga) found a place for themselves as wound disinfectants during the World War. Later (1921) Morgenroth found in rivanol—another acridine derivative—an agent effective in amebic dysentery. Recently, Schnitzer and Silberstein found that the nitroacridines were effective against trypanosomes as well as streptococci. Still more recently a new chemo-therapeutic agent, sulfanilamide, contributed from researches of Domagk (1935), of Trefouel, Nitti and Bovet (1935), and of Buttle, Gray and Stephenson (1936), promises antistreptococcic action that appears to far exceed any of the others so far synthesized. It also finds application in other related fields to be described later.

Introduction

Because the capacity to stain bacteria, as well as certain tissue elements is evidence of some reaction between dyes and the cell protoplasm, it does not necessarily follow that the bacterial organism or cell is destroyed. This latter aspect has been the subject of exhaustive research. The penetrative power as well as the fixative ability has been worked out for many of the dyestuffs. Furthermore, the selectivity of certain dyes for certain tissues has also been studied. For example, Churchman discovered that compounds like gentian violet are destructive to gram-positive bacteria, while fuchsin acted similarly on gram-negative organisms. Within the same group of dyes, one finds a marked variation in bacteriostatic power of the individual members.

It has been observed recently, that beside any bactericidal effect, certain dyes also possess the power to aid healing in certain other ways, such as the stimulation of antibody production or the augmentation of phagocytosis—though these actions are difficult of proof. It has been observed also that certain groups of dyes, such as the fluoresceins are capable of inactivating such highly toxic agents as cobra venom and tetanus toxin, as demonstrated by Noguchi and Flexner. Furthermore, there are certain dyes that are known to inhibit antibody production since they select the reticuloendothelial system as a storage place and form sort of a "blockade" effect. Such a dye is trypanblue. Some authorities believe that certain dyes owe their activity not so much to antibody stimulation, as to the lowering of the resistance of bacteria to phagocytosis, by the production of leucocytosis, febrile reactions, and changes today recognized under the term non-specific protein therapy. It was the work of Morgenroth and Schnitzer, whose results were obtained with certain acridine dyes, in which a hemolytic streptococcus was changed to a green form, that changed our

philosophy of modern dye therapy. As late as 1924, Churchman wrote: "I have never been able to kill organisms circulating in the blood by intravascular injection of gentian violet. At the present time, there is nothing to suggest that it is now possible to do for bacteria what quinine does for malaria." This well-known worker was to live to see the progress with the acridine derivatives in the systemic treatment of bacterial infections. Trypaflavine and rivanol have a pronounced effect *in vivo* on streptococci, with a lesser effect on staphylococci. Some have also reported good results in experimental wound diphtheria. Neufeld, Schiemann and Baumgarten have reported distinct curative effects with trypaflavine in such infections as those caused by pneumoccocci, chicken cholera organisms, anthrax bacilli, and cholera vibrio. Thus, in this one group of recently-synthesized dyes, one finds the big advantage of bactericidal properties unsuppressed by the presence of serum protein or other tissue constituents.

I. The Azo Dyes

Preparations. — Scarlet red (Biebrich scarlet) is chemically, toluylazotoluylazo-b-naphthol. This drug and its ointment (5% strength) are official in the National Formulary. It consists of a brownish red powder, odorless, practically insoluble in water, slightly so in alcohol, acetone or benzene; soluble in oils, fats, phenol, chloroform and warm petrolatum. When the ointment is employed it should be alternated with a simple bland unguent to avoid excessive irritation. There are two other preparations in this group that are unofficial. They are scarlet red sulfonate (the sodium salt of azobenzenedisulfonic acid-azobetanaphthol) and dimazon (diacetylamino-azotoluene). Each of these has the properties described below.

Action and Use.—This group of dyes has the property of stimulating the proliferation of epithelial cells. For this reason the drugs have been found useful in promoting the growth of epithelium in wounds, burns, chronic ulcers, etc. In case of indolent ulcers, it is essential that local circulation be stimulated for permanent results. The scarlet red preparations may be used up to 8% strength, but this percentage is irritant and must be alternated with a soothing preparation, such as another bland ointment. Dimazon is used in 2% strength in ointment, oily solution, or as a dusting powder.

These drugs should not be used in wounds already infected or in the eye. They have not, as yet, proved their worth in stimulating mesenchymal structures, and must not be counted upon in cases such as osteomyelitis. Pyridium (phenyl-azo-alpha-alpha-diamino-pyridine mono-hydrochloride); serenium (diaminoethoxyazobenzene-hydrochloride); niazo (butyloxy-diamino-azo-pyridine); and picochrome (ortho-cresyl-azo-diaminopicoline-hydrochloride) are all azo dyes intended for internal administration as genito-urinary antiseptics.

Of recent interest is another azo-compound, known as prontosil (sulphamido-phenyl-azo-acetylamino-hydroxynaphthalene-disulphonic acid) which, in solution, is employed as the disodium salt (2½%). Tests first made by Domagk in 1935 have indicated it to be practically specific for hemolytic streptococcic infections.

In veterinary medicine prontosil already has been found useful in treating dogs having such infections, in which the animal shows symptoms resembling distemper. The other symptoms include tonsillitis (acute or subacute or chronic), pneumonia, toxemia and nephritis. The bacteria may be isolated from the vaginal discharges or even the milk of pregnant matrons, the litter usually being born dead. The drug has also a possible value in pneumococcal and meningococcal infections.

In humans kidney infections have cleared up remarkably well; and even colon bacilli, staphylococci and the diplococci of gonorrhea have been influenced by prontosil. (Prontylin, or paraaminophenylsulphonamide, is not an azo compound but is a solid form of drug used orally for results similar to those enumerated above for prontosil.) It has been found that the azo linkage is not essential for activity, since this complex is broken up in the animal body anyway. However, the use of either of the latter

drugs is always attended with the danger of sulphemoglobinemia associated with cyanosis. This is especially true if magnesium sulphate is administered simultaneously with or soon after the drug.

II. Acridine Dyes

Preparations and Uses. — Acriflavine (diamino-methylacridine chloride) and acriflavine hydrochloride are yellow powders, soluble in water, slightly so in alcohol, ether, chloroform and oils. The aqueous solutions decompose on standing and boiling increases their irritability. Acriflavine (which is neutral) is less irritant than the other product locally. Unlike most drugs of this type, these have been found more bactericidal in the presence of blood and serum than *in vitro*. In hot solutions the activity is increased, but the action is slow, which is a great disadvantage. It is used in wounds, abscess cavities, and suppurative or gangrenous areas in dilutions of 1:1000 as a wash or wet dressing; or as a 1% ointment. For infections of the eyes, mouth, bladder, urethra, vagina, rectum, etc., it is employed as an irrigation in from 1:8000 to 1:4000 solution. For skin disinfection Bastedo suggests a 5% solution in alcohol (55), acetone (10), and water (35). Oral and most intravenous medication have proved uncertain and cannot safely be recommended here. Rivanol (diaminoethoxyacridine lactate or hydrochloride) and proflavine (diaminoacridin-monohydrogen sulphate) have properties resembling the acriflavines but are not as much used.

III. Fluorescein Dyes (Pyronines)

Preparations.—Fluorescein (resorcinophthalein), eosin (tetrabromfluorescein), flumerin (disodium-hydroxymercurifluorescein), and mercurochrome (disodium salt of dibromohydroxymercurifluorescein) are all included in this group. Eosin has very little application in medicine except as a coloring agent; and flumerin and mercurochrome have been treated under another heading (See article on Mercury, VETERINARY MEDICINE, April, 1937).

Fluorescein is made by the combination of resorcinol with phthalic anhydride. It is an orange-red powder, insoluble in water, ether, chloroform and benzene; soluble in hot acetic acid and alcohol. It dissolves in alkaline solutions, forming a salt. Even in very dilute form, the alkaline solutions show a greenish fluorescence by reflected light.

Action and Use.—The soluble salt is prepared as follows:

Fluorescein 2 grams.
Sodium bicarbonate 3 grams.
Water q.s. 100cc.

It is chiefly employed to diagnose corneal lesions and to detect the presence of foreign bodies embedded in the cornea. Since weak solutions will not stain normal corneas, areas deprived of epithelium, such as ulcers, become greenish and remain so for a long period. Foreign bodies appear to be surrounded by a green ring. Disease of the endothelium of the cornea is indicated by a deep coloration in abnormal areas. Loss of substance of the conjunctiva is shown by a yellow **hue.**

IV. Phenolphthalein Dyes

Preparations and Uses.—This group includes bromsulphalein, phenolsulphonphthalein, phenoltetrachlorphthalein, phentetiothalein sodium, and soluble iodophthalein.

Long used by chemists as chemical indicators, all these except phenolphthalein itself (used as a purgative) are employed in medicine as diagnostic agents. The two drugs, phenolsulphonphthalein and phenoltetrachlorphthalein are used because they pass unchanged through the body and thus give an intense color in the excreta and test kidney function. Bromsulphalein is used similarly except that instead of determining the amount excreted in the bile, the amount not excreted (but found in the blood) gives an index of hepatic functioning. The sodium salts of tetraiodophenolphthalein and tetrabromophenolphthalein are used mainly for their iodine and bromine ions since these appear in sufficient concentration in the gall bladder to permit the heavy halogen molecules to cast a shadow to the roentgen rays. These drugs are known to produce nausea, emesis and diarrhea. They have some bacteriostatic properties but this property has not been taken advantage of.

V. Rosaniline Dyes (Triphenylmethanes)

Preparations and Uses.—The derivatives of triphenylmethane and tolydiphenylmethane used in medicine are those having amino groups combined with them. These include fuchsin (pararosaniline chloride); methyl violet (impure pentamethyl pararosaniline chloride); crystal violet (hexamethylpararosaniline chloride); and gentian violet (a mixture of methyl and crystal violet salts). Acriviolet is a combination of acriflavine and gentian violet. Of these, the most used in medicine are gentian violet (official); and crystal violet.

Gentian violet (methyl-rosaniline) is also recognized officially as methyl or crystal violet. It is soluble in 25 parts of water and 10 of alcohol. Its official solution is 3% and contains 10% of alcohol. It is bactericidal in water and more so in the presence of albuminous fluids. It has been shown by Churchman to be bacteriostatic to gram-positive organisms. It is useful in infected wounds, on mucous membranes, and on serous surfaces as an antiseptic. It is much used in affections of the pleural cavity and of the joints, especially in empyema and arthritis due to staphylococci. Young and Hill have also proposed that the drug be used intravenously in chronic cystitis, septicemia due to staphylococci, and osteomyelitis with staphlococci present. The reactions with this dye have been attributed to flocculation and colloidal reactions, which are not without some danger. Intravenous injections at the rate of 5mg per kilo in humans, is followed by marked cyanosis which persists for a few hours after injection. Enteric coated tablets have been found promising in strongyloides infections. Churchman has proposed a combination of gentian violet and acriflavine, which seem to be compatible, but this has not been sufficiently tested for acceptance. None of these dyes are considered to be strong bactericides.

For direct applications, the gentian violet solutions are used in from 1:500 to 1:1000 strengths; for instillation 1:10,000; for intravenous use, 5mg per kilo body weight, injected in 0.5% solutions; for strongyloides infections, 0.03 gram. The drug has been used as strong as 1% in case of thrush in the mouth, in throat infections, and in empyema. A 1% spray or a 3% jelly made of tragacanth has been recently employed in cases of severe burns. Here it forms a firm, pliable protection, and is antiseptic and analgesic. For skin disinfection, Roberts uses 5% methylene blue and 5% gentian violet in 50% alcohol.

VI. Methylene Blue (Methylthionine Chloride)

This drug is official in the U.S.P. It is freely soluble in water and alcohol, forming a deep blue solution. It is somewhat irritant to the stomach, and is excreted in the bile and urine where it is both antiseptic and analgesic. It stains the urine greenish or bluish. It is only feebly antiseptic, but checks the activity of motile protozoa. Because of its photodynamic action the drug causes light sensitivity in treated animals. Harrop and Baron have found methylene blue to be an oxygen carrier, the respiratory mechanism of the erythrocytes of mammals being enormously increased even when such toxic agents as potassium cyanide or carbon monoxide were present. Hanzlik considers it to be a respiratory stimulant. The drug is not much used topically, but 1% solutions are used in trichomonad infections of the vagina. It is given in small doses to inhibit intestinal protozoa; as an antiseptic and analgesic for the bladder; in actinomycosis; and also in cases of malaria which resist quinine therapy. It has recently been recommended as an antidote in cases of poisoning by carbon monoxide and cyanides, including cyanogenetic plant poisoning.

Conclusion

This field of therapy is new to both human and veterinary medicine. Results are still too indefinite to be fully acceptable to the profession, and it is best to say that their value is "*sub judice.*" This does not mean that eventually these most promising agents of good health will not, in the long run, carve out a niche for themselves in the animal's struggle for survival.

Canine Pediatrics*

VI. Mineral Balance in Feeding Young Puppies[1]

By D. M. CAMPBELL,
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THE mineral or ash components of the animal dietary provide materials which are essential in virtually every physiological process. Iron and copper are necessary to respiration and the blood function. The physical and chemical equilibrium of body fluids and of tissues and nerve cells requires sodium, chlorine, potassium, magnesium, phosphorus, sulphur, iodine and other minerals. The mineral elements calcium and phosphorus form much of the bony structural framework and of the teeth.

Mineral metabolism is a part of the growth process and therefore is of primary importance in the artificial feeding of very young puppies.

THE pediatrician considers most desirable those rates of growth and development which result from a planned feeding regimen calculated to contribute to optimum well-being during the entire life cycle. A human infant may attain considerable weight very rapidly, but whether its tissue structure is chiefly fat or sound muscle is of great importance in determining the desirability of the rapid gain; and in either event the growth is not truly satisfactory unless it is accompanied by corresponding skeletal development, for which an adequate and properly balanced calcium and phosphorus intake is prerequisite. The same principles of integrated growth are equally applicable to the canine species. Mineral metabolism, therefore, takes its place with fat, carbohydrate, and protein metabolism in the artificial feeding of the young puppy.

Mineral metabolism involves transformation reactions and depositions throughout the body. In addition to their rôle as constituents of bone, tooth, muscle and blood tissue, minerals have a part in regulating the solvent properties of body fluids. They are particularly important in maintaining the acid-base balance of the digestive juices, the blood, and other fluids and secretions.

BECAUSE of certain unsound practices prevalent in efforts to feed young puppies, the acid-base regulatory function of minerals is of preëminent significance in this discussion. When milk of any kind—bitch's, cow's, or simulated bitch's milk—is ingested by a young puppy, it is acidified as soon as it enters the stomach and it then is acted upon by the enzymes of the gastric and the pancreatic juices and the bile. It is thus prepared for absorption either into the lymph or directly into the blood stream. The gross components of the fats, carbohydrates and proteins thus broken down are acidic in nature. The blood, however, is slightly alkaline, and it maintains its alkalinity under normal conditions through the action of certain of its constituents which function as buffers. Buffers, in the ordinary sense, are substances which, when in solution, will neutralize acids or bases without in themselves being altered appreciably as to pH value. The principal buffers of the blood are mixtures of carbonates. Sodium carbonate, a biologically strong base, will neutralize a biologically strong acid to sodium bicarbonate, which is only faintly alkaline in reaction. The sodium bicarbonate, in turn, acts upon more acid to form a weak acid, carbonic acid, which readily decomposes into carbon dioxide and water; the carbon dioxide is eliminated by the lungs. Sodium bicarbonate also may act as a buffer toward a strong base and neutralize it to form weaker bases which can be eliminated

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[1] This is the sixth article in a series on the nutrition of young puppies. The seventh installment will appear in an early issue.

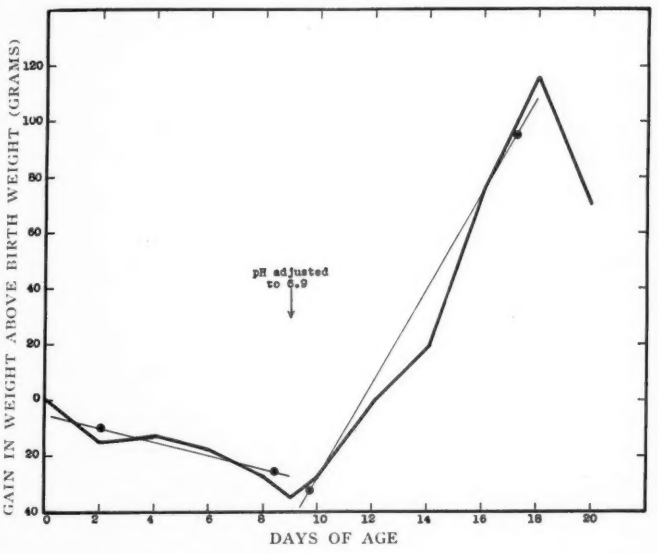
by the kidneys. The alkali phosphates of the blood and the amphoteric nature of the proteins of the blood also play an important part in this same phenomenon.

Minerals have functions of parallel nature and importance in the physiological regulation of other fluid secretions of the body. Any prolonged disbalance of mineral content of a diet fed to a young puppy will, perhaps slowly, but surely, upset these delicate balances and result in ultimate pathological functioning.

or sodium bicarbonate which, as is well known, are required to produce experimental acidosis or alkalinosis, support the view that no significant change in blood pH value or acid-base balance can be induced by ingestion of large amounts of alkaline ash food.

THE gastrointestinal tract, therefore, is analogous to a stable receptor in which deviations are produced only by a prolonged adverse dietary which induces abnormal

CHART X



Graph shows adverse effects of feeding milk formula, basic in reaction, but otherwise satisfactory as to fat, carbohydrate and protein components and balance. For the first nine days the puppy was fed the milk with pH value brought to 7.63 by introduction of sodium bicarbonate. Loss of weight indicates nutritive unbalance. During second period of ten days the pH value was readjusted to that of normal bitch's milk (6.9) but without eliminating sodium bicarbonate. Excellent growth is indicated. However, because of continued presence of excess basic mineral constituent, not reflected in pH value of the formula, sudden reaction occurred on 19th day, accompanied by loss of weight. Puppy died on 20th day as result of upset of normal internal acid-base mechanism.

The focal point of interest in acid-base metabolism of any body fluid—blood, bile or gastric or pancreatic juices—is its characteristic pH value. The pH value, which is a measure of hydrogen ion activity, appears to be, for this particular purpose at least, a more satisfactory means of expressing acidity than in terms of 0.1N HCl (1/10 normal hydrochloric acid).

Through pH determinations accumulating evidence indicates that no appreciable alteration of the internal acid-base balance is possible through use of diets of an acidifying or alkalinizing nature. The extraordinarily large doses of ammonium chloride

functioning of tissue and specialized organs. Improper mineral balance in the dietary is not manifested immediately as in the case of incompatible fat, carbohydrate or protein foods.

In a true sense the acid-base balance is a function of the carbon dioxide tension of the blood stream and of the bicarbonate concentrations. By physical processes the carbon dioxide tension or the bicarbonate concentration may be altered, thus displacing the acid-base balance. The physiological response to fixed acid excess is such that the carbon dioxide tension and the pH value both decrease; the response to fixed alkali

excess is such that the carbon dioxide tension and the pH value both increase.

AN excellent example of this slow manifestation of improper mineral balance is seen in the clinical record (Chart X) of a pup fed a diet perfectly balanced as to fat, carbohydrate and protein constituents, but imperfectly balanced as to mineral content, namely wherein an excess of bicarbonate of soda was fed over a prolonged period. It is a rather common belief that by the addition of sodium bicarbonate to a milk for puppies a degree of alkalinity will be established to overcome many nutritional disorders of the young puppy which are attributed to "acid milk." This vague concept is derived, no doubt, from the old and common practice of modifying cow's milk with lime water for infant feeding. The purpose of such modification of cow's milk in infant feeding is primarily to delay formation of the large curds characteristic of cow's milk casein in the infant's digestive tract—a purpose not concerned with the pH value of the milk.

Sodium bicarbonate as a therapeutic, administered at intervals as competent diagnosis may indicate, has its place in the raising of the young of the canine species as well as in the rearing of human infants, but its continued administration as a dietary component for the establishment of optimal mineral balance is fallacious. The adverse results of such a practice are illustrated in Chart X.

THE pH value of the milk fed to this particular pup was adjusted to 7.63 by the introduction of sodium bicarbonate. The formula was continued for a period of nine days. Not only was there no evidence of proper growth or development, but the puppy lost 32 grams from birth weight during the 9-day period. Disordered digestive functioning was indicated in the fecal condition by a change from normal brown, firm, feces to greyish-yellow feces at the end of the nine days. On the tenth day and thereafter the pH value was readjusted to that of normal bitch's milk, varying from 6.8 to 7.1, with a continuation, however, of the same amounts of sodium bicarbonate as previously used. There was an immediate response to the change as indicated by the fecal condition and by a rapid gain in weight. The improvement continued through the 19th day, when a very sudden reaction occurred; the puppy lost considerable weight, and died on the 20th day.

During this feeding regimen a study was made of the pH values of the feces. During the first nine days the average pH value of the feces was 7.43. During the first five days of feeding the formula adjusted to a pH value approximating that of bitch's milk, the pH value of the feces averaged 7.24. On the 15th day the pH value dropped to 4.92, and on the 16th day it rose to 6.42.

This reaction pattern, typical of many similar cases, is significant, and illustrates strikingly the insidious cycle of events which frequently results from ill-advised, continued attempts to "rectify" the "acid milk" bugaboo.

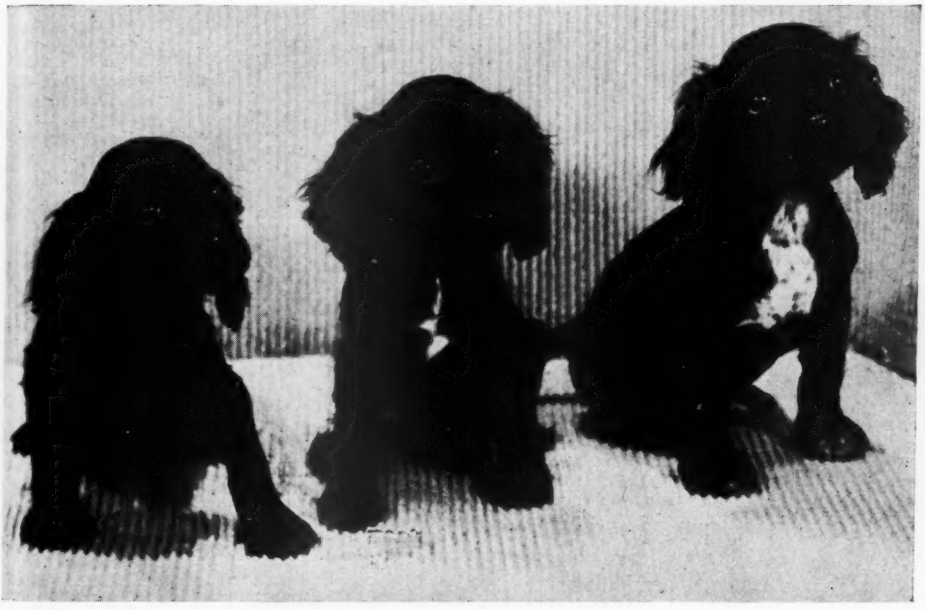
In this instance a basic milk, during a nine-day feeding, proved definitely unsatisfactory, as revealed by failure of the pup to grow, and by alkaline and otherwise abnormal feces. Readjustment of the milk to an acidic condition brought immediate improvement in growth but a delayed change in the pH value of the feces. Suddenly the pH value of the feces shifted from alkalinity to acidity and then toward a lesser degree of acidity.

These changes in the pH value of the feces indicate the violent fluctuations which were induced in the fundamental phenomena of metabolism as influenced by the acid-base equilibrium within the body. The fact that death followed these changes within a few days is of sufficient import to warrant a consideration of just what was going on within the animal's body during the period of maladjustment of mineral balance resulting from mere "adjustment" of the "reaction" of the milk. The initial feedings of the basic milk stimulated the secretion of hydrochloric acid to overcome the excess of basic elements. This, in turn, called for greater secretions of the more alkaline di-

gestive juices in the intestines, and these artificially-induced, excess secretions resulted in digestive disturbances, and alkaline and otherwise abnormal feces. Correction of the basic reaction of the milk temporarily influenced the growth rate, no doubt because of improved absorption; however, mere adjustment of the reaction of the milk did not suffice to remove from the dietary the excess basic elements (sodium bicarbonate), and the continued presence of the basic reaction necessitated a sustained secretion of acid to overcome the excess base. The result was manifested in the appearance of acid feces, stoppage of growth, and death. This case history illustrates the disorganization of body metabolism as the end result of an attempt to correct an improper mineral balance by adjustment of the reaction of the milk without correction of the underlying defect. Promiscuous additions of either alkalis or acids will never meet the puppy's requirements for a balanced mineral diet.

THE foregoing observations are not intended to indict sodium bicarbonate, when intelligently prescribed as a specific therapectic agent to alleviate conditions brought about by temporary dysfunctioning of the digestive tract. Its acknowledged values in such cases will be discussed in detail in a later article in this series.

Aside from their part in maintaining the acid-base equilibrium, minerals are essential as well in the functioning of glandular organs, in the physical and chemical structures of cellular tissue and of body secretions, and in the conformation of the body. The accompanying photograph of three cocker spaniel puppies illustrates some of the more obvious results of a diet disbalanced as to mineral constituents. The puppies in the photograph were fed a milk formula perfectly balanced as to fat, protein and carbohydrate, but not properly balanced as to mineral components. Although these animals grew to maturity and the acid-base balance was within a tolerably satisfactory

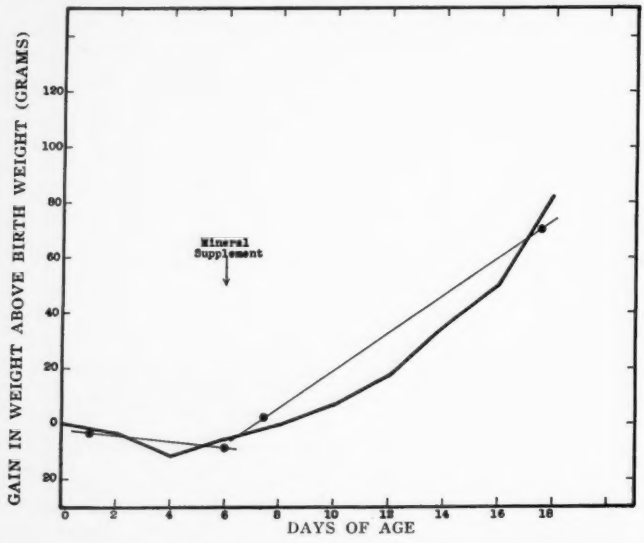


THEIR MINERAL DIET WAS NOT BALANCED

Prolonged improper mineral balance in the dietary of puppies is manifested in faulty body structure and bone conformations. Note the characteristic large heads, gangling legs, and narrow chest cavities of these cocker spaniel puppies whose diet was excellent except for disbalance of mineral components.

range, the mineral components as a whole were otherwise improperly balanced. The disproportionate conformations and general body structures, large heads, lanky, gangling legs, and narrow chest cavities are particularly striking.

IN considering the mineral requirements of the young puppy, it should be borne in mind that animals require more of each of the mineral elements in their food than the total ash content of the body would indicate. This margin is required because of the considerable wastage of mineral elements and compounds in processes of metabolism.



Minerals must be supplied to very young puppies to provide for metabolism, and in sufficient quantities to provide for the rapidly growing body substances, including bones, teeth, and blood corpuscles.

The milk of lactating animals usually is deficient in iron and copper. Nature has provided for this contingency through the storage of these elements in the liver of the new-born. However, since both are necessary for hemoglobin formation, additional amounts over and above that contained in the milk soon must be provided in the dietary irrespective of whether the young is suckled or fed artificially. The same might be said of iodine and possibly of manganese. It is significant that all milks contain substantial amounts of potassium, calcium and phosphorus. The organic phosphorus content of milk undoubtedly serves a function not clearly understood in all respects.

Extended experiments in the Borden laboratories have shown that the compounding of simulated bitch's milk from products compatible as to protein, fat and carbohydrate, appropriate as to quantity and quality, is not successful without further supplementing with the essential mineral components.

CHART XI

Chart illustrates growth response of puppy to proper mineral balance. During the first five days of life this puppy was fed a simulated bitch's milk suitable as to all components except minerals. Light straight line indicating mathematical slope of first growth curve shows puppy lost weight. Proper mineral supplement was added to formula at sixth day. Growth response was striking, although caloric intake was not increased.

The following tabulation of entities and proportions of mineral substances proved to be highly satisfactory for incorporation in simulated bitch's milk:

Mineral Salt	%
Ferric Ammonium Citrate	.5046
Potassium Phosphate, Monobasic (KH_2PO_4)	17.2712
Potassium Phosphate, Dibasic (K_2HPO_4)	4.0733
Calcium Carbonate	55.2962
Magnesium Carbonate	2.5458
Magnesium Sulphate	1.6293
Sodium Chloride	7.0202
Potassium Chloride	11.4052
Potassium Iodide	.0082
Manganese Sulphate	.0352
Aluminum Potassium Sulphate	.0171
Sodium Fluoride	.1018
Copper Sulphate	.0919
Total	100.0000

THE significance of the presence or absence of this group of minerals in an otherwise successful simulated bitch's milk is demonstrated by interpretations of Charts XI and XII.

Chart XI shows the development of a cocker spaniel pup taken from the bitch at birth and given a formula with gross fat, carbohydrate and protein components compatible and in perfect balance, but with the mineral components in disbalance.

The first increment of the growth curve shows the lack of progress during the first five days of life. The mineral salt mixture indicated in the foregoing table was added to the formula on the sixth day. The immediate response was remarkable; with no increase in caloric intake the puppy promptly started to gain weight and the fecal condition became normal within three days.

Chart XII shows clinical data on another cocker spaniel pup, from the same litter as the puppy shown in Chart XI. The pup, taken from the bitch at birth, showed slight gain in weight for the first five days during which the formula, balanced correctly except as to minerals, was fed. The mineral supplement was added to the formula on the seventh day, with immediate improvement in growth rate and gradual return of normal feces.

The calcium and phosphorus contents of bitch's milk have been determined as 0.32% and 0.22% respectively, somewhat higher than those of cow's milk. Calcium and phosphorus ratios, presumably established intrinsically in the normal milk of a given species, are as important considerations as are the quantitative data. This fact has been emphasized during recent years through information obtained incidental to studies of the relation of vitamin D to rickets in humans. Experimental evidence shows that, other factors being constant, a marginal or potentially rachitogenic diet may become an actively ricket-producing diet by variation, frequently only of slight degree, in the calcium-phosphorus ratio.

IT also appears that variation in optimal calcium-phosphorus balance may be influenced by the biological value of the organic phosphorus content of a food, especially the phospholipids associated with milk and milk protein. It is known that the antirachitic value of pure vitamin D, which alone may fail to cure experimental rickets (published work of Supplee and associates), may be enhanced as much as 8- to

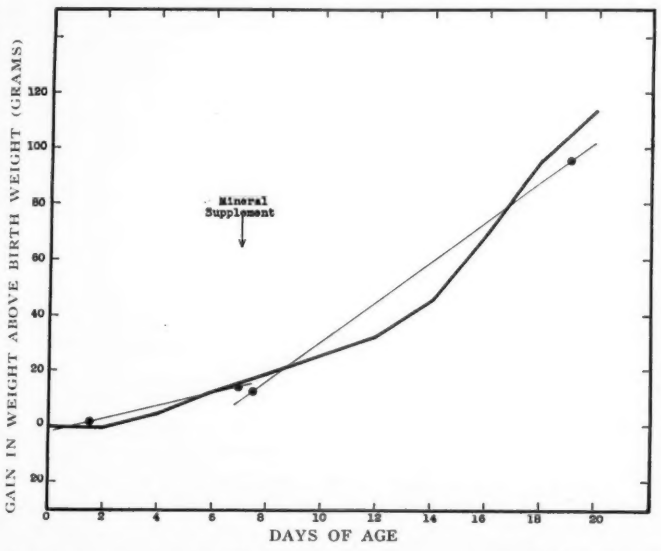


CHART XII

Taken from its mother at birth, the cocker spaniel puppy, whose history is charted in the above graph, gained weight very slowly during first seven days when fed formula, correct except as to mineral balance. Addition of proper mineral supplement induced prompt favorable growth as shown in curve for second increment.

12-fold by the presence of certain milk proteins which do not contain calcium but which are comparatively important sources of organic phosphorus compounds. Conversely, it is well established that the addition to a given dietary of the inorganic salts of calcium and phosphorus do not always accomplish the same physiological results as qualitative additions made by way of the organic complexes contained in natural products, especially in milk. Phosphorus deficiency is manifested in various ways, and it has been reported that disturbances of the estrus cycle in the female and depressed basal metabolism rate are readily traceable to the same deficiency.

IN summary, it may be said that minerals are indispensable in the diets of very young puppies to meet the requirements for body fluid and tissue building, to maintain the correct acid-base balance, and to perform catalytic and regulatory functions in the many processes of metabolism. In an otherwise optimal formula for the artificial feeding of very young puppies, the selection, gross content, and balance of minerals can spell success or failure of the feeding regimen.

A report of the Government Veterinary Surgeon of Ceylon for 1935 states that the marked increase in the incidence of rabies necessitated the destruction of 85,000 stray dogs!

The elimination of guess work in diagnoses is essential for progress in medical science. The race of life is a race for food. The food bill in the United States aggregates the enormous total of $17,500,000.000. It is the greatest bill in this country.—*Fishbein.*

The essentials to "Life, Liberty and the Pursuit of Happiness" are food, fuel, clothing, shelter, medical and dental care and a job. Veterinary medicine is essential to the production of food and clothing, and no people have ever had an adequate or assured supply of either until veterinary science brought the great animal plagues under control.

Reeks' capsules may be given to horses in many gastric ailments, but to prevent any chance of rupture, we like to give a compound salicylic acid capsule first.

Investigators are apt to become very enthusiastic about sanitation and devise methods so complex and expensive that those who practice them go to the poor house. In evaluating any method of sanitation, the economics should not be overlooked. Reasonable sanitation that reduces the chances of contamination 70 to 90% may be very useful in disease control, but perfect sanitation may be of no economic value.—*Van Es.*

Not all diseases can be controlled by sanitation. In a number, sanitation is of no value as a control measure. Pullorum disease of adult birds is one such disease. It is on the whole not transmissible from one adult bird to another, no matter how bad the sanitation. Fowl cholera is another such disease. Its incidence and mortality is not even influenced by sanitation, good or bad, and strangely enough, tuberculosis in adult chickens is not influenced by sanitation.—*Van Es.*

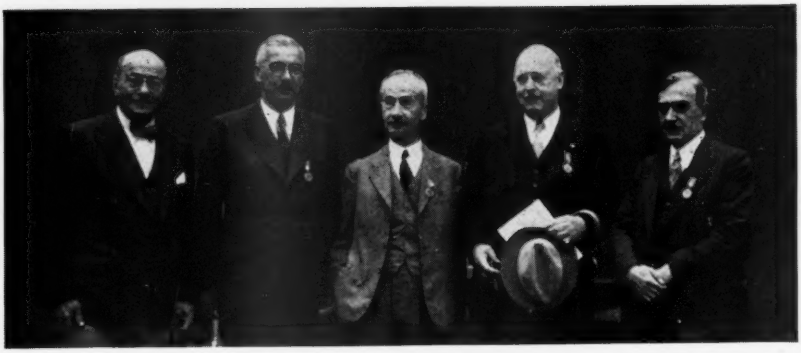
Cockiness

I believe that the trait "conceit" is unique unto man—and it's nothing to be proud of, at that.

Induced by this conceit, every generation considers itself the most advanced and best informed, and those poor devils who were born just a little earlier, are thought quite old-fashioned. And this most advanced generation always flatters itself that it has completely solved many of the problems over which the ancestors pondered in vain—or, perchance, flattered themselves that they had solved them.

When the Alpha and Omega of medical science was "bleeding" it was the most advanced and most beneficent operation, beyond which nothing better could possibly be thought of. . . . Conceit has led us humans into many pitfalls, and, I am afraid, will continue to do so.—S. Boehm, in *The American Kennel Gazette.*

Book Reviews



Left to right: Dr. A. Eichhorn, editor; Prof. Dr. Rudolph Manninger, co-author; Prof. Dr. Joseph Marek, co-author; Dr. John R. Mohler, editor and Dr. J. Russell Greig, editor-in-chief of the Fourth English Edition of Special Pathology and Therapeutics of the Diseases of Domestic Animals

SPECIAL PATHOLOGY AND THERAPEUTICS OF THE DISEASES OF DOMESTIC ANIMALS. By Dr. Franz Hutyra, Late Professor of Infectious Diseases at the Ancient Royal Veterinary College, Budapest; Dr. Joseph Marek, Late Professor of Special Pathology and Therapy at the Royal Hungarian Palatin-Joseph University, Budapest, and Dr. Rudolph Manninger, Professor of Infectious Diseases at the Royal Hungarian Palatin-Joseph University, Budapest. Edited by J. Russell Greig, Ph.D., M.R.C.V.S., F.R.S.E., Director, Moredun Research Institute, Edinburgh, Hon. Research Professor in Animal Pathology, Royal (Dick) Veterinary College, Edinburgh, with the collaboration of John R. Mohler, V.M.D., D.Sc., Chief, United States Bureau of Animal Industry, Washington, and Adolph Eichhorn, D.V.S., formerly Chief, Pathological Division, United States Bureau of Animal Industry, Washington. Fourth English edition. 3 volumes. Cloth bound. 2429 pages. Profusely illustrated; many color plates. Alexander Eger, Chicago, 1938. $31.50.

A new edition of "Hutyra & Marek" is always news in American veterinary circles and this one has been too long delayed. The text has been entirely rewritten and the diction improved. Probably the most noticeable change is the improved typography and better arrangement. Many new illustrations have been added, but though better selected, the reproduction of them seems scarcely equal to that of former editions.

The present work introduces to American readers Prof. Manninger, who, in authorship, acceptably fills the place of the late Prof. Hutyra. The translators too are new —Dr. C. F. Marshall and Dr. Constance M. Ottley. The work of Mohler and Eichhorn, who have had a large part in the preparation of previous English editions of this work, in this edition is ably supplemented by that of Prof. J. Russell Greig, well known to American veterinarians for his part in developing the hypocalcemia theory of milk fever, his revision of Hoare's Veterinary Therapeutics, his extensive research into diseases of sheep and horses, and a number of articles which he has published in VETERINARY MEDICINE. Even under the more exacting requirements of today, "Hutyra & Marek" will resume the place of preëminence it has heretofore held in veterinary literature.

* * * *

DOLLAR'S VETERINARY SURGERY. Edited by J. J. O'Connor, M.R.C.V.S., Professor of Surgery at the Veterinary College of Ireland, Dublin, Examiner to the Royal College of Veterinary Surgeons. Third Edition. Cloth bound. 990 pages. Illustrated. Alexander Eger, Chicago, 1938. $10.00.

The second edition of O'Connor's revision of Dollar's Veterinary Surgery was a disappointment. The reviser seemed to be intimidated by a work that had stood the test of use for 50 years, and lacked much of bringing it up-to-date.

In this edition he has gone almost to the other extreme, including not only all the

recognized changes that have come about in veterinary surgery, but also many operations and procedures that must yet be said to be on trial. However, this is clearly pointed out in the text.

In many respects, the plan of the book has been changed. Anatomical descriptions have been omitted, as have also the repetition of details for each operation and references of dubious value; and the whole text has been made more concise than formorely. This, without increasing the size of the volume, has made possible the addition of much new material, including a section on infections of the skin, a most excellent discussion of anesthesia—nembutal, epiphan, pentothal and epidural—and a discussion of the treatment of fractures. Obsolete illustrations have been replaced by new ones and additional illustrations have been included. With occasional revision such as this, Dollar's Veterinary Surgery may long continue to be the standard work in English on this subject.

* * * *

THE ANATOMY OF THE DOMESTIC ANIMALS. By Septimus Sisson, S.B., V.S., D.V.Sc., Late Professor of Comparative Anatomy in the Ohio State University, Columbus, Ohio, Member of the American Association of Anatomists, Fellow of the American Association for the Advancement of Science. Revised by James Daniels Grossman, G.Ph., D.V.M., Professor of Veterinary Anatomy in the College of Veterinary Medicine, Ohio State University, Columbus, Ohio. Third edition, revised. Cloth bound. 972 pages. 770 illustrations, many in colors. W. B. Saunders Company, Philadelphia, 1938. $12.00.

No description of "Sisson" is called for. It is one book that stands without a competitor among American veterinarians. In the third edition, prepared by a former student of Prof. Sisson, the general plan and scope of the book remain unchanged, except for the addition of a chapter on the anatomy of chickens by the junior author.

The number of illustrations have been increased and a number of the old ones have been replaced by new illustrations presenting the latest developments and the most recent observations.

As in previous editions, the publisher has done a commendable job in supplying an attractive text.

PRINCIPLES AND PRACTICE OF BACTERIOLOGY. By Arthur H. Bryan, M.A., V.M.D., F.A.P.H.A., Science Department, Baltimore City College, and Charles Bryan, M.D., F.R.C.S., Porth Hospital, Porth, England. Cloth bound. 267 pages. Illustrated. Barnes & Noble, Inc., New York, 1938. $2.25.

This work is intended, according to the publisher, for students and workers in bacteriology and an attempt has been made to condense the whole subject of bacteriology into 250 pages. Naturally the discussion of bacteria concerned in the diseases of animals is much too brief for the use of veterinarians and the omissions are too numerous. However, the discussions of such veterinary subjects as are included will be found interesting within the extreme limits of space.

* * * *

TRAITE DES MALADIES INFECTIEUSES DES ANIMAUX DOMESTIQUES (Treatise on Infectious Diseases of Domestic Animals). By L. Panisset, professor in the Alfort veterinary school. 568 pages. Vigot Freres, Paris, 1938. 120 francs ($3.15) plus 15% for postage.

The tome describes 28 infectious diseases of domestic animals, each in a separate chapter. The subjects selected are the outstanding infectious diseases threatening animal production in various parts of the world at this hour. Poultry diseases are not included. Otherwise, no specific infection of world-wide prevalence is omitted, and all known facts appertaining to the chosen subjects are brought up to date in the clear, concise fashion characteristic of this well-known French author and teacher.

The book condenses a wealth of valuable information on geographic distribution, history, diagnostic methods, symptoms, lesions, and treatment. But it is through the details on modern prophylactic measures that the reader's attention is turned to the brilliant achievements of veterinary medicine in recent years. In this respect Panisset's new contribution to the literature is a masterpiece. One searches in vain for notable omissions of available preventive measures and their practical application, and its biological therapy is correspondingly classical—devoid of both indifference and exaggeration.

This work deserves more than usual consideration because it brings up to date the many new discoveries, perhaps well enough known to careful readers of periodical literature, which had not, heretofore, found their way between the covers of a book. Unfortunately, this excellent book is useful only to those who read French.—*L. A. M.*

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SECRETION OF MILK. Dy Dwight L. Espe, Assistant Professor in Dairy Husbandry at Iowa State College, Ames, Iowa. Cloth bound. 265 pages. Illustrated. Collegiate Press, Inc., Ames, Iowa, 1938. $3.00.

This is a discussion of anatomy, physiology and nutrition as it bears upon the normal functioning of the mammary gland. The author states that it is not intended for the practical dairyman nor for the research student, but for the in-between dairy student. However, the veterinary practitioner dealing with mastitis will find the discussion on an acceptable scientific level and valuable to him in his work. The chapter titles are:

Phylogenetic Development of the Mammary Gland; Anatomy of the Udder; Theory of Milk Secretion; Factors Affecting the Amount and Composition of Milk; Nervous Control; Hormonal Control; Miscellaneous Factors Related to Milk Secretion; and Effect of Feed on the Amount and Composition of Milk.

* * * *

NEMATODES PARASITIC IN ANIMALS. By Geoffrey Lapage, M.A., M.D., Institute of Animal Pathology, University of Cambridge, England. Cloth bound. 172 pages. Chemical Publishing Co., New York, 1938. $1.75.

The purpose of this work is explained in the preface as follows:

"No one will deny that nematodes are among the most efficient and effective of the animals that debilitate and destroy both man himself and his domesticated animals. They inflict so much suffering and death that concerted action by workers all over the world is required to bring them under control. A great deal is being done, but the help of more workers is needed. This small book has been written in the hope that it will provide at least a little information upon which others may base the beginning of their work."

The subjects discussed are:

I. Structure, Life-Histories and Classification.

II. Physiology: (1) Nutrition and effects on the host; (2) Oxygen requirements; (3) Protein-Metabolism; (4) Fat-metabolism; (5) Excretion.

III. The Resistance of the Host to Nematode-Infestations: (1) Natural Resistance; (2) Age-resistance; (3) Acquired resistance; (4) Induced passive resistance; (5) Hypersensitiveness, Intradermal, Precipitin and Complement-fixation Tests; (6) Factors that may lower resistance; (7) The nature of natural and acquired resistance.

IV. The Control of Nematode-Infestations.

The subject matter is presented in a pleasing, easily readable style.

* * * *

DISEASES AND PARASITES OF POULTRY. By Edgar Hugh Barger, D.V.M., formerly Pathologist in the Illinois State Department of Agriculture, Urbana, Ill., and Leslie Ellsworth Card, Ph.D., Professor of Poultry Husbandry at the University of Illinois, Urbana, Ill. Second edition. Cloth bound. 386 pages. 81 illustrations. Lea & Febiger, Philadelphia, 1938. $3.75.

The first edition of this work was reviewed in some detail (*Vet. Med.*, 31:1, p. 39). Not a great deal of change appears to have been made in the revision, except to bring it up-to-date on matters in which research has revealed new facts during the past three years.

The publisher states: "This book is designed to aid flock owners in the task of eradicating and controlling transmissible diseases and in improving the health and efficiency of their flocks." Veterinarians too will find it a convenient compilation of the salient facts and findings of research which represents advances made in connection with the all-important subject of poultry diseases.

The authors, one a recognized poultry pathologist and the other a well-known professor of poultry husbandry, are sufficient guarantee of the authenticity of the discussions.

PRACTICAL IDENTIFICATION OF ENDOPARASITES FOR VETERINARIANS. By John H. Whitlock, D.V.M., M.S., Assistant Professor of Veterinary Pathology, Kansas State College of Agriculture and Applied Science, Manhattan, Kans. Mimeographed on one side only. Paper bound. 37 pages. Illustrated. Burgess Publishing Co., Minneapolis, 1938. $1.25.

The following quotation from the preface indicates the scope and purpose of the work:

"This publication is designed primarily for the use of veterinary practitioners, students and others interested in the identification of the internal parasites of domestic mammals. It is meant to bridge the gap between the very complicated science of taxonomy of parasites and the man in the field.

"Rational therapeutics and prophylaxis depend essentially upon accurate diagnosis, and the accurate diagnosis of parasitic diseases rests upon the identification of the parasite. To aid in this task is the object of this publication. In addition it is hoped that it will aid in putting the technical vocabularies of the field and laboratory workers upon a common basis as well as stimulating publication of more accurate data dealing with parasitologic epizoötiology, an important field which is sadly neglected.

"One of the commonest hobbies of the professional man is the collection, identification and classification of various objects. It is hoped that this booklet will stimulate the reader to venture deeper into the extremely fascinating and useful field of parasite toxonomy as an avocation and cause him to increase our really very inadequate knowledge of these forms of life.

"The keys used in this publication are based primarily upon the host, organ and lesion specificity exhibited by most of the common parasites of the domestic animals and only secondarily upon the morphological characteristics of the parasite. By using as a basis for the keys features with which the veterinarian is already well acquainted it is hoped that they will be of more value to him than the usual type."

Twenty-five illustrations of the more important parasites of domestic animals are included in the text.

Equine Encephalomyelitis Virus Fatal To Children

Doctor Fothergill of the Harvard Medical School suspected the cause of more than a score of cases of sleeping sickness in children in Massachusetts with more than 50% mortality to be the same as that which was causing sporadic cases of encephalomyelitis among the horses of the state. A conference was held with Dr. Hans Zuisser, also of the Harvard Medical School, and Col. R. A. Kelser, director of the Army Veterinary Corps, who discovered the mosquito transmission of equine encephalomyelitis. Identification tests quickly determined the suspected virus to be that of equine encephalomyelitis (eastern). The results of the identification tests on laboratory animals were further checked on horses by Dr. H. W. Schoening, chief of the Pathological Division of the B. A. I., and fully confirmed.

So far as could be learned, none of the children succumbing to the infection had been in contact with affected horses. All the evidence indicated mosquito transmission, and the state department of health has outlined its activities on that basis.

The eastern type of equine encephalomyelitis is a highly fatal disease, causing the death of more than 90% of the affected animals in spite of all treatment. However, no outbreaks have yet occurred in which large numbers of animals were affected. The western type of the disease, on the contrary, is fatal in only 20% of the cases that receive proper treatment, but does ocur in waves in which vast numbers of horses and mules are affected. Veterinarians in the Midwest have frequently commented upon the great similarity of the symptoms of the more somnolent cases to those of sleeping sickness occurring in persons in the same territory at the same time. Panisset (*Traité des Maladies Infectieuses des Animaux Domestiques*) reports that the transmission of the disease from horse to man has occurred three times in Nevada, in one case to a veterinarian.